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THE CONVENTION OF THE AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS.

The thirtieth annual convention of the American Institute of Electrical Engineers, which is reported elsewhere in this issue, was a most delightful gathering. The place chosen for the convention was a most comfortable hotel built upon the bank of Otsego Lake, which has been made famous by the novelist of a century ago, James Fenimore Cooper. Except for the latter days of the convention, which were partly rainy, the weather was delightful and added greatly to the success of the convention. The entertainment features were well arranged and were greatly facilitated by the holding of the convention at a summer resort of this kind. While there are some objections to holding a convention at a place as inaccessible as Cooperstown, there are also certain advantages, since the membership is held more closely together and greater opportunities are afforded for making new acquaintances and renewing old ones. Although the section delegates, at the instigation of the representatives of the Pacific Coast sections, passed resolutions favoring the holding of conventions in the larger cities, this should not be taken as representing the sentiments of the entire membership respecting all future conventions. Perhaps the greatest satisfaction can be gained by holding conventions certain years in the large cities and in other years at summer resorts.

The activities of the section delegates did not rest here. Every luncheon hour found them assembled in a private dining room where Institute matters could be discussed to their heart's content and the supply of ammunition usually lasted through the entire afternoon, resulting in the passage of a number of other resolutions regarding the conduct of Institute affairs. Certainly the delegates to this convention must feel that they are devoting a great deal of energy to and taking a very active part in Institute matters.

The papers presented at the convention were mostly of a high order and a number of them were of more than usual importance. This resulted in rather lengthy discussions, which made it evident that entire sessions might well have been devoted to certain of these subjects, such as the specifications for high-tension insulators, power-station costs and electrolytic corrosion of iron. Such an arrangement of the program could, of course, only be carried out by eliminating others of the papers, but this might

well have been done without detracting from the value of the convention. While the number of papers presented at this convention was much smaller than at the last annual convention, a still further decrease might be made with advantage. At the 1912 convention 55 papers were presented and parallel sessions were necessary. This year there were no parallel sessions and but 22 papers were presented at the convention. Even then the time was well filled and some of the papers coming near the end of a session received scant discussion.

While the scheme of placing the different sessions of the convention under the auspices of the various technical committees is a good one, it might be well to limit the number of committees having representation upon the program at any one convention. The greatest value from the convention will thus be attained.

POWER-PLANT COSTS.

One of the most interesting papers presented at the convention was that by Messrs. H. G. Stott and W. S. Gorsuch entitled "Standardization of Method for Determining and Comparing Power Costs in Steam Plants." This paper is worthy of special note for several reasons.

A knowledge of the cost of his output is of great value to every operator of a plant of whatever kind. In the case of power plants the variations in cost have been so wide and an accurate knowledge of the values so limited that the subject makes an appeal to every operating engineer. The determination of that element of generating cost which arises from the purchase of fuel, water, oil, etc., and that due to the labor employed in the engine and boiler rooms, is easy, but when such elements as depreciation and overhead charges are included the problem becomes much more complicated. The authors of this paper have presented an outline indicating what elements should be considered in estimating costs and how some of the general expenses should be apportioned.

Not only is it important for the operator to know just how much it is costing him to generate energy, but improvements in plant management can often be made from a study of the costs obtained by others, and especially by comparison of such other results with those obtained in his own plant. Such comparisons can only be intelligently made when the various elements of cost are computed upon the same basis and such an outline as that proposed is especially valuable for facilitating such comparisons.

It may be well to note here that power-station costs can be divided into two classes, the elements in one of which depend upon the output of energy while those in the other class depend upon the maximum power which the station generates. In the first class are such items as coal, whose consumption is roughly proportional to the energy developed; whereas, in the other class are the fixed charges and other elements which depend only upon the capacity of the plant. These two elements have been well recognized in those systems of rates which distinguish between the cost of readiness to serve and cost of the energy actually supplied. It will be evident from this consideration that the cost of generating power is not purely a power cost nor an energy cost, but contains elements dependent respectively upon each of these quantities.

One of the important points brought out in this paper is the relation which exists between load-factor and the cost of generating a unit of electrical energy. According to the authors, variations in load-factor produce variations in cost, exclusive of fixed charges, which are inversely proportional to the fourth root of the load-factor. For instance, since the fourth root of 0.50 is 0.84 and the fourth root of 0.90 is 0.975, the unit cost of energy when operating at a power-factor of 50 per cent will be 0.975/0.84, or 1.16 times as great as the cost at 90-per-cent load-factor. This relation has been found to hold down to a load-factor of 15 per cent. This relation gives an excellent means of comparing results obtained under different conditions of load and it is suggested that results obtained in different stations be corrected by this formula before making comparisons with other stations.

WILLIAM STANLEY AND THE EDISON MEDAL.

An interesting ceremony at the annual convention of the American Institute of Electrical Engineers was the presentation of the Edison medal to Mr. William Stanley.

The Edison medal was founded upon the initiative of an organization known as the Edison Medal Association, composed of old associates and friends of Mr. Thomas A. Edison, who subscribed a trust fund for that purpose under an indenture dated February 11, 1904, whereby the American Institute of Electrical Engineers agreed to award the medal annually. William Stanley receives the gold medal for 1912 for meritorious achievement in invention and development of alternating-current systems and apparatus. The medal was designed by James Earle Frazer, and bears on its obverse a portrait of Thomas A. Edison, and on its reverse an allegorical conception, "The Genius of Electricity Crowned by Fame." The other recipients have been Prof. Elihu Thomson, 1909; Mr. Frank Julian Sprague, 1910; Mr. George Westinghouse, 1911.

William Stanley has been a conspicuous figure among technical men since the earliest developments of practical electrical apparatus. Long ago he took a commanding place in establishing the fundamentals upon which have been based a great deal of the development which has come about in electrical machinery during the last quarter of a century. To his individual credit must be conceded the demonstration of the commercial feasibility of the alter-

nating-current system, thus providing the means by which electricity could be served through comparatively small electrical conductors over considerable distances. The solution of this problem was at Great Barrington in 1885, and in some of the most extensive distribution systems today practically all of Stanley's apparatus is in use in some form or another.

In the early summer of 1892, Stanley with his associates, Mr. John F. Kelly and Mr. C. C. Chesney, brought out the first successful Stanley alternating-current motors. As the use of these motors suffered from the limitation of the then available generating apparatus, Stanley proceeded to the development and manufacture of a proper type of alternating-current multiphase generator, producing what is now well known to electrical men as the inductor type of machine.

Mr. Stanley also contributed very materially to the development of apparatus for the manufacture of incandescent lamps, and originated the Stanley wattmeter. Of late years he has devoted himself to research work, and has made great strides in the development of a greater utilization of heat-resisting materials and insulators for the perfection of electrical heating and cooking apparatus.

In company with the other eminent ones who have thus been distinguished through the presentation of the Edison medal, we are glad indeed to write down our endorsement and appreciation of the signal honor which has thus come to Mr. Stanley.

EMPHASIZING WEAK SPOTS IN THE MECHANICAL DRIVE.

Rising standards of service in the power supply of large factories should encourage the central-station solicitor facing the difficult problem of securing business under the handicap of an existing low cost of steam-engine driving. The more one studies industrial plants, the clearer it becomes that the great majority of installations depending upon the mechanical drive are exceedingly susceptible to improvements in the arrangement of machinery and the internal administration of factory departments. Conditions automatically tend toward lower levels of efficiency as the life of the plant increases, and often in old plants weak spots are allowed to remain in the face and eyes of the owners simply through that toleration which grows out of long familiarity with local surroundings. This is only another way of saying that every central-station solicitor in the power field should be a self-constituted efficiency expert ready to seize upon the advantages of electric driving in all their collateral importance as well as in their direct economy of operation.

In seeking these lines of attack upon a plant it is essential to obtain a close idea of the variations in output from time to time and their demands upon the power-plant capacity of the installation. Taking the case of a shoe factory producing 200 dozen pairs of shoes per day and operated by an 85-horsepower engine, it is noteworthy that an increase in the output to 300 dozen pairs heavily overloaded the engine and cut its speed down from 108 to 105 revolutions per minute despite the use of a governor designed to maintain the full speed. The engine output rose to 116 horsepower, and yet 500 employees serving the most modern machinery for shoe production were obliged to work at an appreciably slower rate because the diminished engine speed was felt all along the line from the power house to the smallest stitcher. The maintenance of normal speed under all possible conditions is literally of the utmost consequence to the modern manufacturer, and recognition of this has lead all well managed hydroelectric power companies and central stations to spend large sums upon ways and means of holding system frequency close to the mark and thus supplying the best kind of service for alternating-current motors.

The plant owner rarely appreciates the friction losses in his installation, which sometimes exceed 60 or 70 per cent of the total power output. The experienced engineer advocating electric-motor service will do well to assure himself that nothing of which capital can be made is overlooked in assembling his estimate data. Thus, in the factory above, the plant was belted from the engine room to the top floor, with no sectionalizing devices except for the sewing machines, making it most uneconomical to run one department at a time. Overtime work in this establishment was common at least twice a week, making it necessary to waste a good many times the actual energy consumption in the transmission. It was also a common occurrence for the whole factory to be shut down in order to tighten a single loose pulley. Again, it was found that a large blower consuming about 25 horsepower in one department was belt-driven from a department on the floor above, making it necessary to operate the latter at all times that dust-collecting machines were run elsewhere. The factory owners made much of the point that all scrap leather and leather dust were burned under the boiler, but close observation showed that this gave little useful heat and clogged the grate so that more frequent cleaning of fires was necessary, with losses in the fuel account correspondingly greater. During the investigation of the economics of steam and electric driving in this plant the grates became so badly choked one morning that the fires could not be kept up, and the steam pressure dropped until it became necessary to shut down the engine and consequently the entire installation. Still another mechanical defect was a chimney of leaky flue connections and insufficient height.

Although it is often next to impossible to assign an accurate money value to points of this kind, the best power engineers are keen to detect them in dealing with individual situations, and except in the latest and most improved plants, there are almost always opportunities to emphasize these weak features.

Meeting of the Society for the Promotion of Engineering Education.

The twenty-first annual meeting of the Society for the Promotion of Engineering Education was held in Minneapolis, Minn., June 24 to 26 inclusive. The principal sessions were held in the new engineering building of the University of Minnesota and in the West Hotel, the latter being a joint session with the American Water Works Association. A comprehensive series of papers was presented by members and non-members covering many of the important phases of engineering education and allied matters. Several of these took tangible form in committees appointed to carry out the suggestions presented in the papers. For example, a paper by E. V. Huntington of Harvard University on "The Units of Force" was partly instrumental in causing the appointment of a Committee on the Teaching of Mechanics to Engineering Students. In another paper D. M. Wright suggested the appointment of a committee to study and report upon the standardization of technical terms. This suggestion was carried out.

The presidential address of William T. Magruder, of Ohio State University, was devoted to the qualifications required in a good instructor. He pictured an ideal instructor as one who knows his subject but is also in mental reach of his students; who has the highest reputation for honesty, right living, patience and sound character; who is in practical touch with the subjects he has to teach and who has unbounded enthusiasm for the work of both teacher and engineer.

Other important papers treated of the construction of buildings for technical schools, instruction in highway and in hydraulic engineering, in shop-work and in drawing. The general subject of academic efficiency was discussed by H. S. Person, director of the Amos Tuck School of Tufts College. A. C. Humphreys, of the Stevens Institute of Technology, and G. F. Swain, of Harvard University, championed the four-year course as against five years or longer, while the opposition was led by F. H. Constant, of the University of Minnesota.

The results of the operation of the systematic grading system in use at the University of Missouri was described by A. L. Hyde. F. P. McKibben, of Lehigh University, called attention to the advantage of summer work for engineering students and explained how his students arrange for such work.

A very interesting session was devoted to engineering college shop practice and engineering drawing. J. V. Martenis and W. H. Richards described how shop work is made attractive and stimulating to the students by making the exercises lead to something definite. An extensive exhibit was used to illustrate the working out of the plan.

T. E. French, of the Ohio State University, a most successful teacher of engineering drawing, showed how this subject can be taught effectively. Among other papers, one by C. E. Sherman and R. K. Schlafly, of the Ohio State University, described a novel practice of sending civil engineering students into commercial work during the summer under the direction of instructors, if the students could not obtain regular summer employment. H. Wade Hibbard, of the University of Missouri, presented directions for thesis work and gave a long list of subjects suitable for investigation. Ivy L. Lee, of the Pennsylvania Railroad Company, gave some excellent suggestions from the employers of technical graduates to the teachers, indicating how the latter can exert helpful influence in the right direction. These suggestions were well received and provoked considerable discussion.

In addition to the papers there were committee and officers' reports, all of which showed the Society to be in good condition and alive to its opportunities.

A number of social functions and excursions increased the pleasures of the meeting and enabled the members to meet the faculty of the University of Minnesota and their families and to appreciate the remarkable beauty of the country around Minneapolis.

The following officers were elected: President, G. C. Anthony, Tufts College; vice presidents, H. S. Jacoby and A. C. Humphreys; secretary, H. H. Norris, Cornell University; treasurer, W. O. Wiley, New York, N. Y.; councillors, H. W. Tyler, J. F. Hayford, A. S. Langsdorf, S. M. Woodward, M. S. Ketchum, F. P. Spalding, and P. F. Walker.

Central Railway Association. Meeting.

More than 250 members of the Central Electric Railway Association from Ohio, Indiana, Kentucky, Illinois and Michigan, assembled in Toledo, O., last week and on Wednesday afternoon with their wives left aboard the steamer *St. Ignace* for a two-day convention cruise. Sessions were held on board boat while the party traversed the waters of Lakes Erie, St. Clair and Huron. Many representatives of railway supply companies joined the excursion. Little business of importance was transacted, as the June meeting was designed to be a social affair.

Electric Club Meeting.

Stringent laws, politicians and the inability of the city government and the traction companies to get together were blamed for Chicago's inadequate transportation facilities by Frank Hedley, vice-president and general manager of the Interborough Rapid Transit Company of New York, who spoke on June 26, before the Electric Club of Chicago. Mr. Hedley said the same obstacles existed in New York and had to be remedied before that city obtained satisfactory transportation.

Conditions in New York as regards transportation were discussed in detail and considerable data presented on the increase of transportation facilities, volume of traffic handled, and the few accidents reported. The effect of transportation facilities on real estate values was mentioned and typical cases cited. The public's need can best be met by granting the transportation companies long-term franchises, with regulation, and in the case of subways having the city and the companies enter into partnership.

Before the address of Mr. Hedley, the Club approved the resolutions proposed by the committee on Patent Legislation.

The meeting was the last one to be held until September although plans are being made to hold a picnic soon.

Meeting of Philadelphia Illuminating Engineers.

At the meeting of the Philadelphia Section of the Illuminating Engineering Society on the evening of June 20, James Barnes, professor in Bryn Mawr College, gave a talk on "Recent Ideas in Regard to the Spectrum." This was followed by an address on "The Problem of the Relation of the Human Eye to Illumination, Natural and Artificial," by Wendell Reber.

The results of the election for section officers were announced as follows: Chairman, George A. Hoadley; secretary, L. B. Eichengreen; managers, F. C. Dickie, H. H. Gauser, S. Snyder, Harold Calvert and H. A. Hornor.

Wireless to Norway.

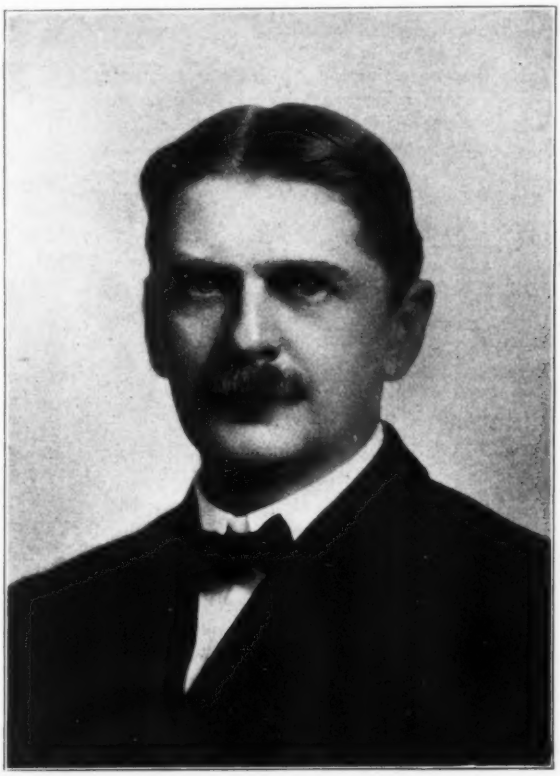
The Norwegian Storthing on June 28 sanctioned a contract between the Norwegian Government and the Marconi Company providing for a wireless service between Norway and the United States. The Government will spend $560,000 for a station at Stavanger to connect with Boston.

City Electrician Wanted.

Los Angeles (Cal.) officials are looking for an electrician who is capable of superintending the fire alarm and police telegraph systems of that city.

C. E. Scribner.

The development of telephone service as we know it today has been the work of many minds, and in the history of this phase of electrical communication many names are written large for their fame and for the fortunate outcome of their inventions. In facilitating the widespread use of the telephone as a common instrument of communication between widely scattered points of the compass, the development of the modern switchboard has been one of the most conspicuous advances. In this connection the subject of this sketch, Charles E. Scribner, has played a most important part. His achievements in the development of the art of telephone communication have made him not only one of the foremost figures in this field in America, but as well an engineer of recognized international standing.



Charles E. Scribner,
Chief Engineer of the Western Electric Company.

Mr. Scribner became interested in telegraphy when a boy, and before he was 18 years old had invented a telegraph repeater. Happening to visit the Chicago factory of the Western Electric Manufacturing Company for the purpose of having a model of his invention made, he became acquainted with E. M. Barton, the founder and head of that company. Through Mr. Barton's influence young Scribner secured a position as inspector of printing telegraph apparatus in a local telegraph company. A year later, in August, 1877, he secured a position in the laboratory of the Western Electric Manufacturing Company, where he really began his career as an investigator and inventor. He was then 19 years of age, but he immediately took up research and development work, covering various fields of electrical activity.

As a result of his genius and enterprise there is hardly any branch of the art of telephony that has not felt the impress of his influence. His greatest contribution to science is embraced in his development of the multiple switchboard, and he is probably in a greater degree than any other man responsible for the perfection of this fundamental nerve center of the telephone business, which is the foundation of practically the entire telephone industry of the world.

This work has made Mr. Scribner one of the greatest factors in the patent situation in the industry. He has been chief engineer of the Western Electric Company and the directing mind of its engineering activities since the company's small beginnings more than 30 years ago. During the period in which he has filled the position of chief engineer he has been granted 425 patents.

Mr. Scribner was born February 16, 1858, at Mt. Vernon, Ohio. He has been identified with many technical organizations, notable among which is the American Institute of Electrical Engineers. He served upon its board of managers, is a member of the Edison Medal Committee, and has just been elected a vice-president. He is a trustee of the United Engineering Societies, and was a delegate to the International Technical Conference held in France in 1910.

International Electrical Congress.

Preliminary plans for the International Electrical Congress which is to be held in San Francisco during the week beginning September 13, 1915, in conjunction with the Panama-Pacific International Exposition, and under the auspices of the American Institute of Electrical Engineers, are being effected by the Committee on Organization.

In the week preceding the Congress there will be a meeting of the International Electrotechnical Commission.

The Congress is being divided into twelve sections, arranged as follows:

I.—Generation, Transmission and Distribution.—Central-station and substation design, control and operation. Long-distance transmission of electric power.

II.—Apparatus Design.—Generators, motors and transformers. Prime movers and their relations. The rating of machinery.

III.—Electric Traction and Transportation.—City, surface and rapid-transit railways; interurban and trunk lines; electric vehicles, ship propulsion, mining railways, elevators and hoists.

IV.—Electric Power for Industrial and Domestic Use.—Factories, mills, refrigeration, heating devices, etc.

V.—Lighting and Illumination.—Arc and incandescent lighting; the science and art of illumination.

VI.—Protective Devices; Transients.—Switches, circuit-breakers; condensers; electrostatics; disruptive phenomena; high-frequency phenomena.

VII.—Electrochemistry and Electrometallurgy.—Electrolytic and metallurgical apparatus and processes.

VIII.—Telegraphy and Telephony.—(a) All communication of intelligence by the use of wires. (b) Electromagnetic waves and radio telegraphy and telephony.

IX.—Electrical Instruments and Electrical Measurements.—Switchboard, portable, standard and absolute instruments. Testing and standardization methods; absolute measurements.

X.—Economics of Central Stations and Systems.—Load-factors, power-factors and all problems affecting the economy of central stations; also rates and regulation by public-service commissions.

XI.—Electrophysics.—Radioactivity; Röntgen rays; gas and vapor conduction; electron theory; constitution of matter.

XII.—Miscellaneous.—History and literature of electrical engineering; symbols and nomenclature; engineering education and ethics, etc.

In each section it is desired to include as many notable papers as practicable, dealing with the status or the progress of the art. Offers of papers and suggestions in this connection should be directed to the secretary of the Committee on Organization, E. B. Rosa, Bureau of Standards, Washington, D. C. The president of the committee is Charles P. Steinmetz and the business manager is Preston S. Millar, of New York City.

Tests on Postal-Car Illumination.

A meeting of the Chicago Section of the Illuminating Engineering Society was held on June 27 at the rooms of the Western Society of Engineers. Chairman F. A. Vaughn presided and announced the result of the letter ballot on election of officers for the Section for the ensuing fiscal year to be as follows: M. G. Lloyd, chairman; J. B. Jackson, secretary; Nelson M. Black, J. W. Pfeifer, C. C. Schiller, M. J. Sturm and H. B. Wheeler, managers.

A. J. Sweet, of Milwaukee, Wis., presented a paper entitled "Notes on Postal-Car Illumination," which dealt with the exhaustive tests on this subject conducted at Washington, D. C., about a year ago and with which Mr. Sweet was prominently identified. These tests were made for nearly two months on a railway mail car loaned for the purpose by the Baltimore & Ohio Railroad. They were impartially conducted under the joint auspices of the Association of Railway Electrical Engineers, the Post Office Department and the manufacturers of car-lighting equipment, the latter financing the entire research. Instruments were frequently checked at the Bureau of Standards. For the illumination-intensity survey of the entire car it was divided into some 45 rectangles, each about 10 square feet in area and constituting a test station. The tests with electric lighting were the most extensive; these were nearly all made with 50-watt tungsten lamps spaced in succession 5 feet, 7.5 feet and 10 feet apart. Both the center-deck and half-deck arrangements were tried out. Tests were made with 14 kinds of reflectors and also with bare lamps. Indirect lighting was also tried out and the effects studied of using improper or dirty reflectors and of mounting the reflectors incorrectly. Quite a few tests were also made with gas lighting using mantle lamps with various reflectors. One group of tests was made with oil lamps.

There are three distinct parts to a postal car. The end sections are for the storage of sacks of mail; here only sufficient light is needed to read the tags on the sacks occasionally. In the sack-rack section the clerks stand between rows of open sacks among which mail is sorted; here sufficient illumination must be provided for close visual work at the reading level (about 46 inches from the floor) and at the mouths of the bags to clearly define them. In the letter-case section both vertical and horizontal illumination must be adequate for proper sorting of letters in the various pigeon holes. The shadow effect must not be objectionable when clerks stand in various normal positions. The illumination must be adequate, uniform and free from glare so as to conserve the eye efficiency of the clerks; it must also be of high physical efficiency because the facilities for providing the electrical energy or stored compressed gas are limited on a railroad car.

A study of these features was made in the tests. Ten observers, most of whom were trained in the railroad postal service, judged as to the sufficiency of the illumination and as to when it was ample, these being the minimum and maximum illumination intensity for comfortable visual work. Observations were made with the car standing and also when making a roundtrip between Washington and Philadelphia.

Among the results of the tests was the determination of the efficiency of various reflectors, which showed up in the following order of the five highest types: (1) mirrored-glass reflectors, (2) clear prismatic reflectors, (3) heavy-density opal (Iris), (4) aluminumized metal, (5) medium density opal. The indirect system met with favor on the part of the postal men, bnt was not nearly as efficient as the best direct types. Shadows were least objectionable with the lamps in the middle of the center deck. Placing the lamps on the side or half deck gave practically equal efficiency and distribution results, but the half-deck system is more costly in installation and maintenance. Observations with the car in motion bore out the preceding conclusions, but it was found that a slightly lower intensity was needed.

Probably the most important result of the tests was the draft of government specifications for postal-car illumination. These are unique in being of a broad nature laying down the requirements to be met by whatever type of equipment is furnished; illumination specifications have hitherto almost invariably merely given details to be observed in the installation of some specific commercial type of equipment. Among the requirements insisted on are a minimum service illumination of 2.25 foot-candles. The reflectors must be so arranged as to shield the lamp for at least all angles beyond 20 degrees above the horizontal.

The discussion of Mr. Sweet's paper was participated in by J. R. Cravath, L. L. Holladay, F. H. Bernhard, F. A. Vaughn and Mr. Sweet. The latter called attention to a comprehensive research on the lighting of steam railroad day coaches which has just been begun at Cleveland, O., and which promises to bring out as much, if not more, information respecting the proper illumination of this type of car as the research just reported on the illumination of postal cars. By undertaking similar, comprehensive investigations on other classes of illumination, such as office and factory illumination, many or perhaps practically all of the moot points respecting thereto could be cleared up.

Arrangements for Convention of Illuminating Engineering Society.

It has been decided to make the Hotel Schenley the headquarters of the Illuminating Engineering Society convention, which will be held in Pittsburgh, Pa., September 22-26. The hotel is in a popular residence section which is rapidly becoming a civic center. It is in easy walking distance of the Carnegie Museum and Library, Carnegie Technical Schools, University of Pittsburgh, several prominent clubs and the Soldiers' Memorial Hall. The last mentioned building will prove of particular interest to illuminating engineers because of the wonderful lighting effects used therein.

The program as outlined at the present time covers an exceedingly interesting set of papers.

In addition to the technical sessions of the Society, the Local Committee has arranged for a series of entertainment features in which the ladies are included. These features cover golf, tennis, baseball, automobile rides, theater and card parties, and a banquet at which some innovations are promised.

Inspection trips have been arranged to several industrial plants including the Westinghouse Electric & Manufacturing Company, Macbeth-Evans Glass Company and the Carnegie Steel Company; also a luncheon at the H. J. Heinz Company for the ladies.

An interesting feature in connection with the technical sessions will be the holding of symposiums on various subjects to be led by those particularly well posted on the different subjects.

A Transportation Committee has been appointed, consisting in part of the secretary in each city having a local section, which will perfect arrangements for members and friends in obtaining transportation to and from Pittsburgh.

General Electric to Build New Plant.

Plans for a group of buildings to be known as the Minneapolis Mazda Lamp Works, to be erected by the National Quality Lamp division of the General Electric Company, have been announced. The initial investment will be $560,000. Work will be started on the new building at once, and it will be ready for operation January 1, 1914

Electricity in Broom Manufacturing.

The many advantages of electric motor drive which have been recognized by manufacturers generally, apply with equal force in broom manufacture. The most important items are uniform speed. reduced fire risks, flexibility, and reliability. Conditions in a typical plant are discussed and data on several other plants given.

It has not been many years since power machines in broom manufacturing plants were unknown, yet, today motor drive has become firmly established in this industry and machines which heretofore were considered as capable of being operated only by foot or hand power are being successfully driven by electric motors.

The advantages which accrue from the use of motor drive in other industries apply with equal force in broom-manufacturing plants. Of particular importance is the advantage of uniform speed, this resulting in an increased production of from 10 to 20 per cent.

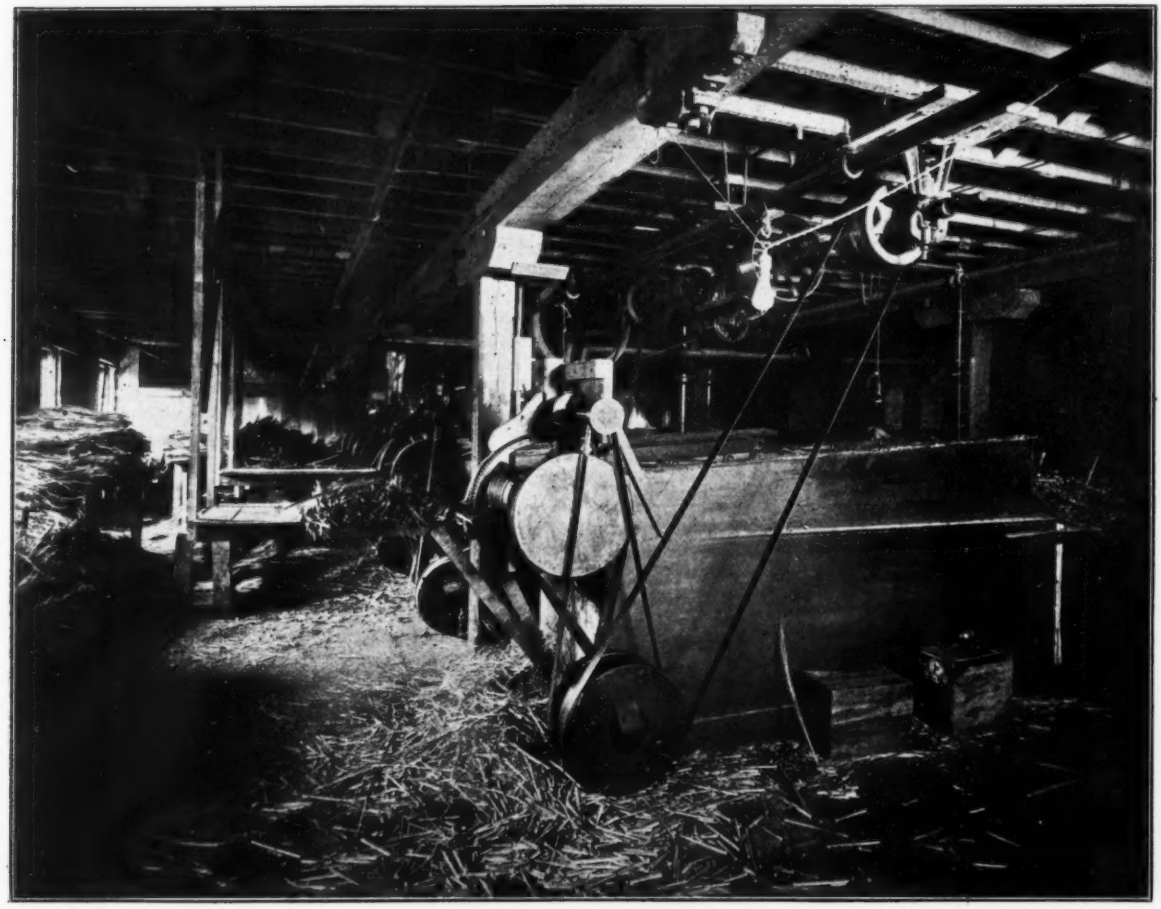


Fig. 1.—Motor Driving Group of Sizing Machines in Broom Factory.

The flexibility of motor drive is also an important advantage as it permits machines to be arranged so that a minimum amount of handling is necessary, and each machine has a maximum facility for rapid work. As labor is such an important item in the cost of broom manufacture, any system of drive which facilitates the arrangement of machinery for the best possible routing of material should be welcomed by manufacturers.

Reduced fire risk attending motor drive is worthy of serious consideration on the part of broom manufacturers since the reduction in insurance premiums will, in many cases, go far in making up for the original cost of the electrical installation.

Broom manufacture requires a number of machines each taking a comparatively small amount of power, and operating at constant speed. The load on each machine fluctuates rapidly and at fairly regular periods. For these reasons as well as for the fact that the machines themselves are naturally rather closely grouped together, group drive is, for the most part generally used. On account of the diversity-factor among the machines group drive permits of the use of a fewer number of motors of much less aggregate horsepower than could be obtained with individual drive.

Owing to the nature of the product handled and the service the machines are called upon to perform, direct-current motors should be of the shunt type and alternating-current motors of the squirrel-cage induction type. Where direct-current motors are used these should, whenever possible, be suspended from the ceiling or otherwise placed so that there will be no danger of fire in case of motor sparking. Conditions in broom manufacturing plants as regards the sizes of the

Fig. 2.—Motor Operating Broom Tying Machines.

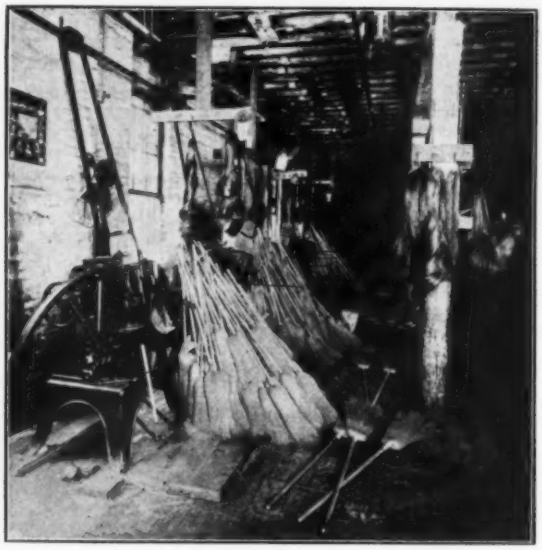


Fig. 3.—Motor Operating Broom Sewing Machines.

motors required for the various operations involved, and the application of the motors to the driven machines, can be well illustrated by a description of a typical establishment located in Chicago and purchasing power from the Commonwealth Edison Company This plant has an average output of 275 dozen brooms and 15 dozen wisk brooms per week of 54 hours.

The factory is a modern three-story brick building designed to receive natural light from three sides. The various machines and departments are arranged so that the handling, both of the corn as it is being made into brooms and the finished product, is reduced to a minimum.

The broom corn as it is received at the factory is taken to the top floor where the various sorting and grading operations are carried on. These are mostly done without the use of machines. The first operation in which power-operated machines are employed is that of cleaning the corn and removing the seed. In the plant in question a three-horsepower shunt-wound motor is installed, driving a double scraper which resembles an emery wheel and revolves at a high rate of speed. The seed pods are torn apart and the seed removed when the corn comes in contact with these rapidly revolving wheels. The motor in this case is suspended from the ceiling and belted direct to the machine as shown in Fig. 5. The motor operates at a speed of 1,800 revolutions per minute.

Fig. 4.—Motor-Driven Trimmer.

Fig. 5.—Motor-Driven Scraper.

Broom Manufacturing Data—Sheet No. 1.

The term load-factor is used in these data in such a sense that a load-factor of 100 per cent represents the use for 24 hours every day of power corresponding to the rated capacity of the motors connected. An operating-time load-factor of 100 per cent represents the use of the rated capacity of the motors for the running hours per day specified for each installation.

Broom manufacturing plant having an average output of 275 dozen brooms and about 20 dozen whisk brooms per day. There are 45 men and 15 girls employed, working 9 hours per day.

Total connected horsepower, 23.5. Total number of motors installed, 8. Average kilowatt-hours per month, 650.

Kilowatt-hour consumption for 12 months:

Month	Kilowatt-hours	Month	Kilowatt-hours	Month	Kilowatt-hours
January	624	May	707	September	428
February	583	June	801	October	518
March	555	July	528	November	505
April	657	August	411	December	1,490

Load-factor, 5 per cent; operating-time load-factor. 12 per cent.

Motor Installation.

The following is a list of the motors installed with their respective drives. The supply source is 220 volts direct current. All motors are of the shunt-wound type.

No.	Horse-power.	R. P. M. Speed	Application.
1	3	1,650	Belted to a 40-foot 9-hanger line shaft driving seven Lipe & Walrath No. 104 broom sewing machines, capacity six dozen four-string brooms per hour; and one trimming machine.
1	5	1,050	Belted to a line shaft 75 feet long (17 hangers) driving 22 F. W. Reese tying machines for tying corn to handles.
1	1.5	1,050	Belted direct to one scraper for cleaning broom corn after brooms have been assembled.
1	3	1,800	Belted to 22 feet of shafting (11 hangers), driving one punch press; one band saw; one handle machine; one drill press; one disk saw; one broom-handle lathe; and one banding machine.
1	3	1,800	Belted direct to one double scraper.
1	1	1,800	Belted direct to one Harrah & Stewart bumper for evening ends of corn.
1	2	1,100	Belted to a 10-foot line shaft, five hangers, driving four sizing machines.
1	5	1,100	Driving elevator mechanism for 2,000-pound freight elevator.

Small broom factory located in Kansas. The operation of the plant is intermittent.

Total connected horsepower, 8.5. Total number of motors installed, 2. Average kilowatt-hours per month, 109. Average kilowatt-hours per month per horsepower connected, 13.

Kilowatt-hour consumption for 12 months:

Month	Kilowatt-hours	Month	Kilowatt-hours	Month	Kilowatt-hours
January	256	May	118	September	118
February	97	June	93	October	111
March	166	July	61	November	89
April	157	August	82	December	67

Load-factor, 2.4 per cent.

Motor Installation.

The following is a list of the motors installed with their respective drives. The supply source is 500 volts, direct current.

No.	Horse-power.	Speed R. P. M.	Application.
1	3	1,200	Belted to a line shaft driving one Lipe & Walrath No. 104 broom sewing machine, capacity six dozen four-string brooms per hour; one hurl cutter; one broom cylinder; and one twin reel.
1	5.5	.....	Direct-connected to mechanism of a one-ton freight elevator.

Broom manufacturing plant having an average output of 500 dozen brooms per week. There are 20 employees working 10 hours per day.

Total connected horsepower, 7. Total number of motors installed, 2. Average kilowatt-hours per month, 369. Average kilowatt hours per month per horsepower connected, 52.6.

Kilowatt-hour consumption for 12 months:

Month	Kilowatt-hours	Month	Kilowatt-hours	Month	Kilowatt-hours
January	475	May	370	September	297
February	391	June	362	October	401
March	368	July	267	November	331
April	439	August	248	December	348

Load-factor, 9.6 per cent; operating-time load-factor, 20 per cent.

Motor Installation.

The following is a list of the motors installed in this plant with their respective drives. The supply source is three-phase, 60 cycles, 220 volts. The motors installed are of the squirrel-cage induction type.

No.	Horse-power.	Speed R. P. M.	Application.
1	2	1,800	Belted direct to one broom-corn trimmer.
1	5	1,200	Belted to a 12-foot line shaft, four hangers, driving two Lipe & Walrath broom-sewing machines; two broom scrapers for removing seeds; and two tying machines.

Broom Manufacturing Data—Sheet No. 2.

Pioneer Broom Works, Amsterdam, N. Y. This plant has an average output of 350 dozen brooms per day and 70 gross of whisk brooms per week. The plant operates 60 hours per week.

Total connected horsepower, 41.5. Number of motors, 13. Average kilowatt-hours per month, 2,510.

Kilowatt-hour consumption for 12 months:

Month	Kilowatt-hours	Month	Kilowatt-hours	Month	Kilowatt-hours
January	1,620	May	2,360	September	3,040
February	3,120	June	2,600	October	2,850
March	2,680	July	2,130	November	2,100
April	3,020	August	2,860	December	1,750

Load-factor, 11 per cent; operating-time load-factor, 23 per cent.

The approximate electrical energy consumed per dozen brooms made is 0.45 kilowatt-hour.

MOTOR INSTALLATION.

The following is a list of the motors installed in this plant with their respective drives. The supply source is three-phase, 60 cycles, 220 volts. All motors are of the squirrel-cage induction type.

No.	Horse-power	Speed R. P. M.	Application.
1	5	1,200	Belted to a 30-foot line shaft, 10 hangers, driving 12 George F. McCombs hand-stitch broom-sewing machines.
1	3	1,200	Belted to a 40-foot line shaft, 14 hangers, driving 14 broom tying machines.
1	2	1,200	Belted to a 10-foot line shaft, 5 hangers, driving three Van Sickler sizing machines for sorting corn according to length.
1	3	1,200	Belted to a 25-foot line shaft, 10 hangers driving 11 tying machines.
1	2	1,650	Belted to a 14-foot line shaft, five hangers, driving two Van Sickler sizing machines; and two broom-corn scrapers.
1	2	1,200	Belted to a six-foot line shaft, three hangers driving two whisk-broom sewing machines.
1	3	1,200	Belted to a 16-foot line shaft, five hangers, driving three hurl-cutting machines; and one bumper for sorting out heavy stems.
2	2	1,800	Each belted direct to one corn scraper.
1	3	1,800	Belted to a 10-foot line shaft, five hangers, driving four corn scrapers.
1	5	1,200	Belted to a 20-foot line shaft, eight hangers, driving 10 hurl-cutting machines.
1	2	1,200	Belted to a short line shaft driving two George F. McCombs hand-stitch broom-sewing machines.
1	7.5	1,200	Belted to elevator mechanism.

Broom factory having a capacity for 55 dozen brooms per day while the average output is from 45 to 50 dozen per day. There are 15 men employed working 50hours per week.

Total connected horsepower, 5. One single-phase motor is installed. Average kilowatt-hours per month, 242. Kilowatt-hour consumption for 12 months:

Month	Kilowatt-hours	Month	Kilowatt-hours	Month	Kilowatt-hours
January	214	May	231	September	255
February	254	June	240	October	383
March	240	July	187	November	250
April	174	August	260	December	220

Load-factor, 9 per cent; operating-time load-factor, 21 per cent.

The approximate electrical energy consumption per dozen brooms made is 0.2 kilowatt-hour.

MOTOR INSTALLATION.

The following is a record of the motor installation. The supply source is single-phase, 110 volts.

No.	Horse-power	Speed R. P. M.	Application.
1	5	1,750	Belted to a 16-foot line shaft, five hangers, driving two Baltimore broom sewing machines; four power broom tying machines; and two broom scrapers for removing seed.

Broom factory having an average output of 300 dozen brooms per week. There are 15 men employed working 60 hours per week.

Total connected horsepower, 4.75. Total number of motors installed, 8. Average kilowatt-hours per month, 270. Kilowatt-hour consumption for 12 months:

Month	Kilowatt-hours	Month	Kilowatt-hours	Month	Kilowatt-hours
January	376	May	350	September	139
February	300	June	270	October	185
March	275	July	200	November	330
April	190	August	270	December	321

Load-factor, 10 per cent; operating-time load-factor, 21 per cent.

MOTOR INSTALLATION.

The following is a list of the motors installed in this plant with their respective drives. The supply source is two-phase, 60 cycles, 220 volts.

No.	Horse-power	Speed R. P. M.	Application.
2	0.25	1,140	Each belted direct to a Johnson improved broom tying machine.
1	0.25	570	Belted direct to a Lipe & Walrath hurl cutter and sizing machine.
1	0.5	1,700	Belted direct to one Boogs broom scraper.
1	1	1,700	Belted direct to one F. W. Reese clipper.
1	2	570	Belted direct to one Baltimore hand-stitch broom sewing machine.
2	0.25	1,200	Each belted direct to a Johnson improved broom tying machine.

After the corn has been cleaned of seed the next step in the cycle of operation is to sort it according to the length of the straws. Four sizing machines are used for this, the function of these machines being simply to carry the corn over screens of various lengths, the short-length straws dropping through the first screen, etc. Altogether there are six lengths into which the corn is classified. A two-horsepower shunt-wound motor operating at a speed of 1,100 revolutions per minute is belted to a 10-foot line shaft from which connection is made to each of the sizing machines. Fig. 1 is a view of these machines, the motor in this instance also being suspended from the ceiling, removed from dust and straw.

To even the ends of the corn before being assembled into brooms, a machine known as a bumper is employed. A one-horsepower motor operating at a speed of 1,800 revolutions per minute is belted directly to the bumper.

The corn is then ready to be assembled into brooms, machines known as tying machines being used for this purpose. These machines which secure the corn to the broom handles require very little power and until recently were operated by foot. A five-horsepower motor running at 1,050 revolutions per minute drives 22 of these machines. The plant is also equipped with 16 foot-operated tying machines.

From this department the assembled brooms are taken to another scraper where the loose ends of the corn are cleaned and separated, and then to the stitching machines. In this department there are seven Lipe & Walrath broom sewing machines and one trimmer for trimming the ends of the corn, all driven by a three-horsepower shunt-wound motor running at 1,650 revolutions per minute. The sewing machines, shown in Fig. 3 each have a capacity of six dozen four-string brooms per hour.

A patented broom having a metal base for securing the corn to the handle is also manufactured in this plant, a few special machines being installed for this purpose. Instead of being placed in the tying machines the corn is put in a punch press between the two halves of the metal base referred to, which secures the corn. A handle machine is then used to secure the base and the handle. Other machines in this department are, one band saw for trimming the corn after the broom has been assembled in the metal base; one handle lathe for turning the handles so that they will fit the bases; one banding machine for banding the brooms; one drill press and one disk saw. All these machines are driven by a three-horsepower shunt-wound motor, running at, 1,800 revolutions per minute.

Another typical plant that employs motor drive with excellent results is that of the Pioneer Broom Works at Amsterdam, N. Y. The use of electric drive here has increased production between 10 and 15 per cent, the ony extra expense being for materials.

The average output is 350 dozen brooms per day and 70 gross of whisk brooms are also made per week. The average monthly consumption is 2,510 kilowatt-hours and the approximate energy consumption per dozen brooms made 0.45 kilowatt-hour. Squirrel-cage induction motors are used throughout.

In the preparatory processes five sizing machines and eight scrapers for cleaning corn are employed. A two-horsepower motor operating at a speed of 1,200 revolutions per minute is belted to a line shaft driving three Van Sickler sizing machines and another two-horsepower motor running at 1,650 revolutions per minute operates two sizing machines of the same make and two scrapers. There are six additional scrapers, two driven by individual motors of two-horsepower size running at 1,800 revolutions per minute and four grouped on one three-horsepower motor of the same speed.

In this same department, in which the preliminary operations are carried on, are three hurl cutters and one bumper, for evening corn, driven by a three-horsepower motor running at 1,200 revolutions per minute; and one five-horsepower motor operating at the same speed driving 10 hurl-cutting machines.

Altogether there are 25 broom tying or winding machines installed in this plant. One battery of 14 machines is driven through line shafting by a three-horsepower motor, running at 1,200 revolutions per minute, and a motor of the same size and speed drives a battery of 11 tying machines.

In the sewing department a five-horsepower motor, operating at a speed of 1,200 revolutions per minute, is employed to drive a battery of 12 George F. McCombs hand-stitch broom sewing machines, and two sewing machines of the same type are grouped on a two-horsepower motor. A two-horsepower motor running at 1,200 revolutions per minute is also used for operating two whisk-broom sewing machines. All of the auxiliary machines in this plant are operated by motors.

Complete motor data on this and additional installations will be found in the accompanying data sheets.

Commercial Practice
Management, Rates, New Business

COST OF MANUFACTURE IN SIX MEDIUM-SIZED CENTRAL STATIONS.

By E. F. Lathrop.

The cost of manufacture in medium-sizes central stations is usually greater than in the large stations where the latest advances in power generation are represented in the mechanical and electrical installations. Many of the smaller companies are limited by their resources, and as their stations are enlarged much of the older machinery remains in place, resulting in a combination of the old and new types of apparatus in use at the present day. As the majority of the central stations are of medium size, a comparison of the costs of manufacture of six Massachusetts companies may be of interest. The following data were taken from the operating records of the companies for the year ending June 30, 1912. Steam is used entirely in all of the power plants. An outline of the mechanical and electrical equipment of each power house is given, enabling a comparison of the different installations.

The Quincy Electric Light & Power Company serves a population of about 33,000. Its generated energy during the year amounted to 2,165,163 kilowatt-hours, of which 862,368 kilowatt-hours were sold. The company's boiler plant consisted of two 200-horsepower Babcock & Wilcox water-tube units, and

two 300-horsepower outfits of the same make, aggregating a capacity of 1,000 horsepower. The engine equipment included a 240-horsepower Providence cross-compound condensing engine and a 450-horsepower unit of the same make, and a 1,000-horsepower Cooper cross-compound engine; the total rating was 1,690 horsepower. There were three direct-connected General Electric alternators of 150, 300 and 800 kilowatt capacities, respectively. The station force was comprised of the following men: four engineers, one helper and four firemen.

The Suburban Gas & Electric Company serves a territory having a population of about 28,000. It generated 2,444,508 kilowatt-hours, purchased 261,772 kilowatt-hours and sold 1,365,836. The company's plant was shut down during the time the purchased electricity was used. The boiler plant of 1,208 horsepower, included four 302-horsepower Stirling units. The engine equipment consisted of two Rice & Sargent compound condensing engines of 550 horsepower and 750 horsepower each, and a 750-horsepower Parsons steam turbine. The total engine rating was 2,050 horsepower. There were three 2,300-volt, three-phase, General Electric machines, one of 400 kilowatts, and two 500 kilowatts capacities, one of the latter being driven by the turbine. The station labor force included three engineers, one oiler and two firemen.

The Gloucester Electric Company serves a population of about 30,000. The company generated 1,331,139 kilowatt-hours, and solid 883,432 kilowatt-hours. The boiler equipment consisted of four 125-horsepower Roberts horizontal tubular boilers; the total capacity was 500 horsepower. The engine installation included one 400-horsepower Allis-Chalmers, one 750-horsepower Cooper-Corliss engine, and a 670-horsepower General Electric turbine with a 500-kilowatt generator on the electric end. The remaining electrical equipment was comprised of three General Electric machines of the following ratings: 150, 200 and 600 kilowatts. The immediate station labor included three engineers, one oiler and three firemen.

The North Adams Gas Light Company serves a territory having a population of about 40,000. It generated 4,792,810 kilowatt-hours, and sold 3,725,798 kilowatt-hours. The company's boiler plant of 1,560 horsepower consisted of seven 205-horsepower Hazelton boilers. The steam equipment included one 1,500-horsepower Allis-Chalmers turbine and two 750-horsepower units of the same make, with one 1,000-kilowatt and two 500-kilowatt machines, respectively, on the electrical end. The station labor force included four engineers and six firemen.

The Salem Electric Lighting Company, serving a population of about 60,000 people, generated 5,631,280 kilowatt-hours, and sold 3,589,931 kilowatt-hours. The boiler installation included five 350-horsepower Babcock & Wilcox water-tube boilers. The engine equipment consisted of a General Electric Curtis turbine of 3,750 horsepower rating and three vertical cross-compound McIntosh & Seymour units of 635, 900 and 1,500 horsepower, respectively. The turbine gave only a limited service, as it was installed during the year. The total engine capacity was 6,785 horsepower. The electrical equipment included one 2,500-kilowatt turbine generator and 2,300-volt, three-phase, direct-connected alternators of the following ratings: 400 kilowatts, 600, 1,000 and two 200 kilowatts. The total capacity of the generators was 4,900 kilowatts. The station labor force included four engineers, three switchboard men, three firemen, three coal passers, and two wipers.

The Fall River Electric Light Company serves a population of about 124,000. During the year the company generated 7,293,783 kilowatt-hours, and sold 4,094,749 kilowatt-hours. The boiler plant had a total rating of 2,100 horsepower, and consisted of six 350-horsepower Babcock & Wilcox units. The total engine equipment of 8,666 horsepower consisted of four General Electric Curtis turbines of the following ratings: one 667 horsepower, one 5,333 and two 1,333 horsepower, with 2,300-volt alternators of the following capacities on the electrical end: one 500, 4,000 and two 1,000 kilowatts, respectively. The immediate station labor included a force of eighteen men.

The maximum station load for the Suburban and Gloucester companies occurred during the summer months, due to the fact that the territories served included summer resorts.

Hongkong Company Prosperous.

The boom in electric light and power affairs in Hongkong, China, is illustrated in the fact that the Hongkong Electric Company, Limited, has declared a 16-per-cent dividend on its capital stock of $600,000 local currency ($288,000 gold at present exchange), besides passing 5 per cent to reserve and writing off over 20 per cent of total capitalization in allowance for plant depreciation. The net profit the past year was $277,712 local currency ($133,302 gold).

	Quincy Electric Light & Power Company	Suburban Gas & Electric Company.	Gloucester Electric Co.	North Adams Gas Light Co.	Salem Electric Lighting Co.	Fall River Elec. Light Co.
Kilowatts capacity	1,250	1,400	1,450	2,000	4,900	6,500
Kilowatt-hours generated	2,165,163	2,444,508	1,331,139	4,792,810	5,631,280	7,293,783
Kilowatt-hours sold	862,368	1,365,836	883,432	3,725,798	3,589,931	4,094,749
Cost of fuel	$14,975.85	$14,976.74	$11,251.53	$32,344.80	$28,792.86	$34,163.84
Cost of rentals				58.08		
Cost of oil and waste	652.56	371.19	691.55	224.69	2,091.85	899.78
Cost of water	1,239.94	1,669.19	1,327.93	2,742.54	2,305.46	1,206.34
Cost of wages at station	8,624.79	8,679.11	7,282.42	9,892.80	15,153.12	13,668.91
Cost of station repairs	379.85	492.86	1,464.75	1,338.70	1,332.00	1,688.15
Cost of steam-plant repairs	2,071.35	1,774.41	1,369.42	3,282.92	2,804.99	1,538.22
Cost of electric-plant repairs	325.28	181.61	54.61	973.50	628.77	635.54
Cost of station tools and appliances	118.13	544.09	471.75		1,322.74	1,489.99
Total cost	$28,387.75	$28,689.20	$23,913.96	$50,858.03	$53,431.79	$55,358.77
Cost per kilowatt-hour, cents	1.310	1.172	1.794	1.061	.948	.759
Fuel cost per kilowatt-hour, cent	.691	.612	.844	.675	.511	.468
Labor cost per kilowatt-hour, cent	.398	.354	.54t	.206	.269	.188
Miscel. cost per kilowatt-hour, cent	.221	.206	.404	.180	.168	.103
Tons of Fuel Burned—						
Cumberland	2,685	3,226	2,746		7,769	
Screenings	910	161	196			
Buckwheat		690				
Bituminous				7,319		9,669
Anthracite Scrn.				25		
Gas Coal				1.24		
Average Cost per ton, $—						
Cumberland	4.60	3.97	3.91		3.71	
Screenings	2.88	1.90	2.00			
Buckwheat		2.68				
Bituminous				4.34		3.53
Anthracite Scrn.				1.00		
Gas Coal				4.50		
Max. Station Load, kilowatts		1,500	710	1,680	2,060	2,550
Date		Sept. 4, 1911	Aug. 26, 1911	Nov. 17, 1911	Nov. 29, 1911	Dec. 18, 1911

Meeting of Brooklyn Company Section.

The annual convention and banquet of the Brooklyn Company Section of the National Electric Light Association was held at Manhattan Beach, N. Y., June 25.

The program consisted of a brief address by Vice-Chairman C. E. White, outlining the work covered during the past year; following this came the official business, which consisted of the report of the various committees, and then W. H. Grove, winner of the 1913 National Convention Competition, gave his impressions of a trip to Chicago.

Next in order, W. E. Babcock, presented a review of various technical papers and reports presented at the Chicago convention, after which the papers were thrown open to discussion.

Following Mr. Babcock's paper, T. W. Flowers read a paper prepared by F. H. Patterson, of Rochester, and presented at the Chicago convention. This paper also brought forth quite a little discussion.

Following Mr. Flowers, M. S. Seelman, Jr., presented a review of the Commercial Section papers and reports, read at the Chicago convention. This paper brought forth a number of good discussions especially in connection with the subject of refrigeration. This concluded the papers for the day.

The secretary then read a number of amendments to be made to the constitution, which will be voted upon at the next regular meeting.

The Chairman appointed a Nominating Committee, composed of the following members: G. L. Knight, chairman; F. W. Slater, A. G. Gumaer, C. W. Hafstrom, R. E. Bauer, E. W. Babcock and J. L. Wiltse, after which the session adjourned for a short recess.

At 6:30 p. m. the members again convened in the Banquet Hall of the Oriental Hotel, where they were the guests of the Edison Electric Illuminating Company of Brooklyn at dinner, at which 600 were seated.

The Committee on Arrangements, composed of E. A. Baily, chairman; J. G. Bogeart, I. Bugg and B. F. Rush, had all details well in hand, and the banquet was a great success.

Directly at the close of the dinner, W. F. Wells, vice-president and general manager of the company addressed the members on the elements of personal efficiency. After Mr. Wells came W. W. Freeman, vice-president of the Alabama Interstate Power Company, formerly vice-president of the Brooklyn Edison Company. Mr. Freeman's subject was the hydroelectric developments of the country, especially those with which he is now connected.

The Nominating Committee then rendered their report which was unanimously accepted. The slate for the coming year being as follows:

Chairman—C. E. White.
Vice-Chairman—W. H. Grove.
Secretary—J. G. Bogeart.
Treasurer—F. C. Hill.

The new Executive Committee is composed of: W. J. Honan, J. D. Butt, E. A. Leslie, T. Cusack, P. H. Bugg, H. J. Tilden, W. F. Schaller, S. B. Mintram, J. G. McNelus, R. J. Freese and W. F. Wells.

Baltimore Sign Attracts Attention.

The accompanying illustration shows the slogan of the Associated Advertising Clubs reproduced as an electric sign which was erected in Baltimore, Md., during the annual convention of this organization.

The sign was 60 feet high by 60 feet wide. The lettering was in white—the outline of North and South America

Electric Sign Erected in Baltimore During Advertising Convention.

in green and the two circles in red. The word "Truth" remained on constantly—then the outline of the two continents appeared—then the outer circle of red and finally the lettering.

This sign was presented to the Associated Advertising Clubs by O. J. Gude to be displayed wherever the Clubs are in session. It will also occupy a position on top of the proposed Advertising Building at the Panama-Pacific Exposition in San Francisco.

New Appliance Room in St. Louis.

The Union Electric Light & Power Company, of St. Louis, Mo., on June 25, opened its new electric appliance show rooms in its office building at Twelfth and Locust Streets. On opening day a special discount of 10 per cent was made on all purchases of electrical appliances.

The production of anthracite coal in Pennsylvania in 1912 was 75,310,049 long tons, valued at the mines at $177,767,054, an average price of $2.36 a ton.

Display-Room Car of the Middle West Company.

The new exhibit car which the Middle West Utilities Company has equipped with central-station devices to be carried as a portable electrical show-room from place to place left Chicago on July 2 on its initial trip to the various properties operated by this company.

The car is built especially for exhibit purposes from designs prepared by Mike S. Hart, general manager of the commercial department of the Middle West Utilities Company. The car will serve as both a display room and traveling office. It resembles a standard baggage coach in exterior appearance, and measures 60 feet in length and weighs 40 tons.

Inside the car is installed a complete exhibition of lamps, appliances, fans, heating and cooking devices, etc., for demonstrating the conveniences of central-station service. The width of the vehicle, 9 feet, permits of giving moving-picture shows for the education and entertainment of those who visit the exhibit. One end is fitted up as a new-business office with all the usual conveniences.

For exhibition purposes in the towns where it is to be used, the car will be sidetracked in some convenient location where it will be accessible to the local public. Energy to operate the displays will be taken from the lines of the local system. The car is, of course, without motors and will be attached to regular railroad trains for transfer from one display point to another.

Central-Station Legislation in Connecticut.

The legislature of Connecticut, which has recently adjourned, enacted the following measures of interest to central stations and electric railways:

Authorizing the city of South Norwalk to sell electric energy from its municipal plant to the Norwalk and New Canaan Electric Railway Company.

Extending the field of the Danbury and Bethel Gas & Electric Company to include the town of Brookfield.

Extending the field of the United Illuminating Company to include the town of Woodbridge.

Amending the charter of the United Electric Light & Power Company to increase its capitalization so as to construct a generating plant.

Extending the field of the Sharon Electric Light Company to include the town of Shrewsbury.

Granting a charter to the Stafford & Monson Street Railway Company, to construct between Stafford Springs and Monson.

Electrical Construction

ELECTRICAL EQUIPMENT OF THE PACIFIC MILLS NEW PRINT WORKS DEPARTMENT.[1]

Further Notes on Direct-Current Installation and a Description of Wiring for the Lighting System.

By Theodore A. Bergen.[2]

In the last installment of this article a part of the description of the wiring to the printing-machine motors was included. In order to continue this discussion properly it will be necessary to repeat two of the figures which has been already used. The printing machines are installed on the second floor and are driven individually by motors installed in the gallery or third floor, the motors being belted to the main-drive pulley of the machines. The machines are divided into four groups, with twelve in each group. Each such group is fed by a separate circuit.

The feeders are run on the ceiling of the first story, where are also installed the disconnecting switches and controllers. These disconnecting switches and controllers are operated from the floor above, where the printing machines are located, by means of shafts or handles through the floor, one on each side of the machine. Figs. 25, 26, 27 and 29 show typical details of construction and wiring for the printing machine and motors and controllers and will serve to give a clearer idea of the arrangement.

The operating device for the controller is located to the right of the print-

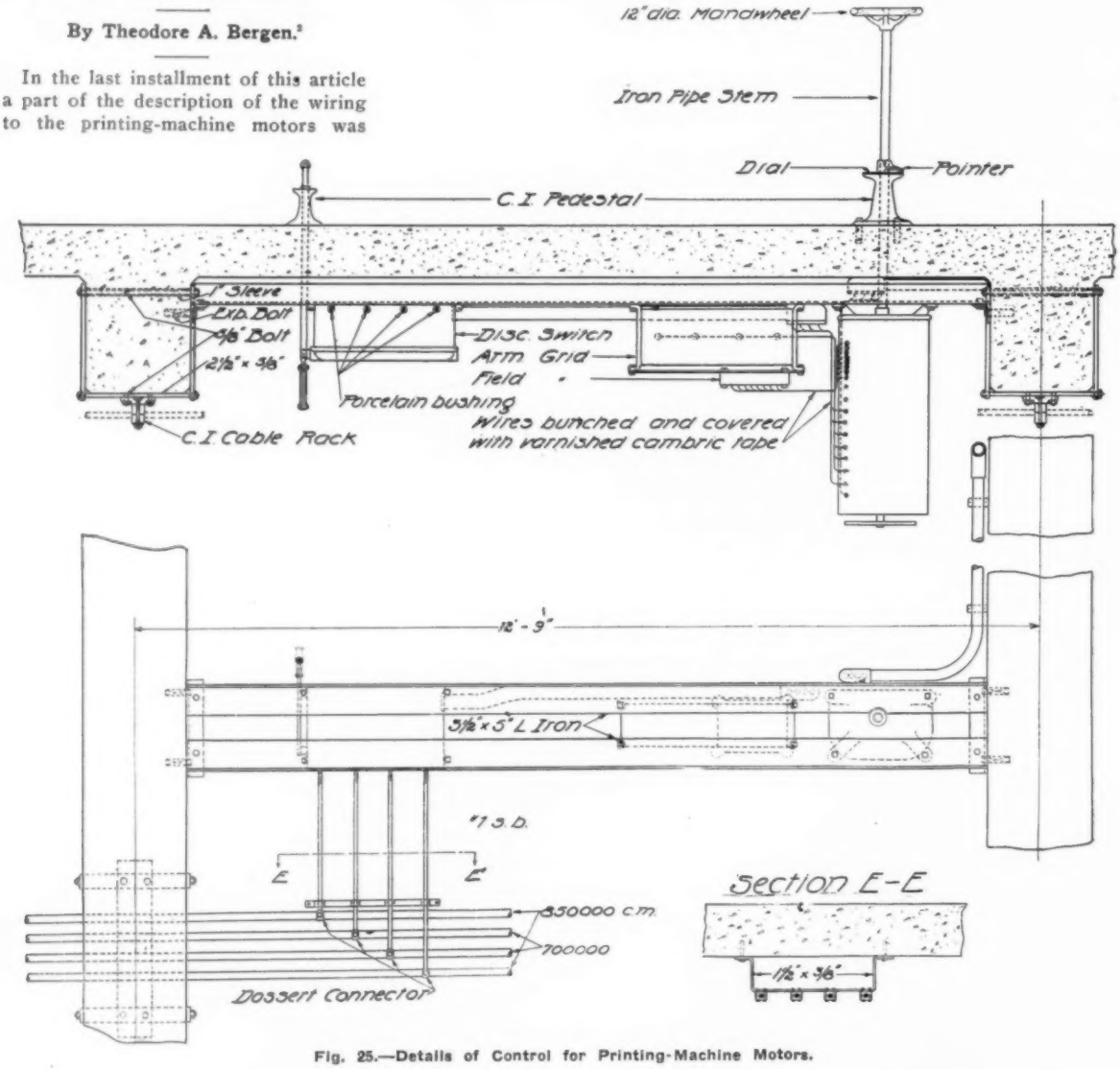


Fig. 25.—Details of Control for Printing-Machine Motors.

1 Third installment.
2 Electrical Engineer with Lockwood, Greene & Company.

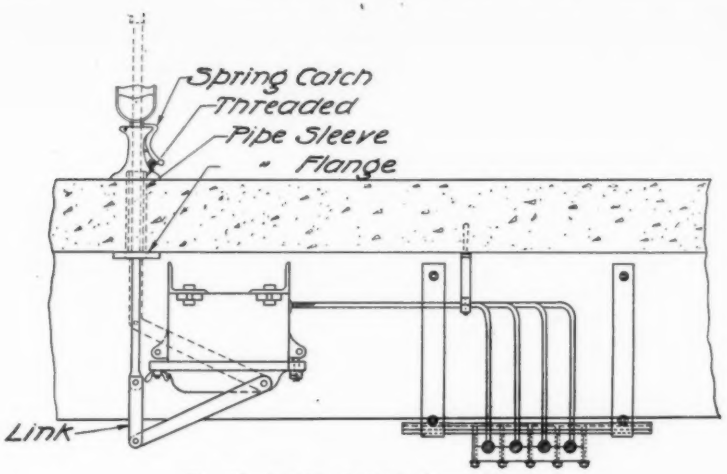


Fig. 26.—Further Details of Controller.

ing machine and in such position that the operator can make the necessary adjustment while standing in front of the machine and watching the goods, but at the same sime there is left an opening between it and the machine big enough to allow the operator to easily pass through for the purpose of adjusting gears or mandrils. The device consists of a pipe stem about two feet 6 inches high, equipped at the top with a handwheel 12 inches in diameter. It is supported by a cast-iron pedestal which is screwed on to a pipe sleeve installed in the concrete floor. This pedestal has a dial on the top of it with certain markings on it and thus a pointer on the shaft indicates the position of the controller at any time. The pipe stem on shaft passes through this pedestal and the pipe sleeve and engages to the shaft of the controller below. The stem with hand-wheel is easily removable, so that when rolls or mandrils are being changed on the machine it can readily be removed and put out of the way.

The handle for the disconnecting switch, being on the opposite side of the machine, is supported by a similar pedestal, but one which is much smaller than the one for the controlling device. The pedestal with the entire mechanism extends about a foot above the floor. The switch is opened by pushing the handle down. This switch is to be operated only in case of emergency or while repairs are being made on some parts of the equipment.

The switch and controller with its resistance grids are bolted to a framework of angle iron, suspended between the beams in the first story. A view of this construction is shown in Fig. 30, while Figs. 25 and 26 represent the same in detail.

The switch is fused with four 150-ampere fuses, which protect the motor

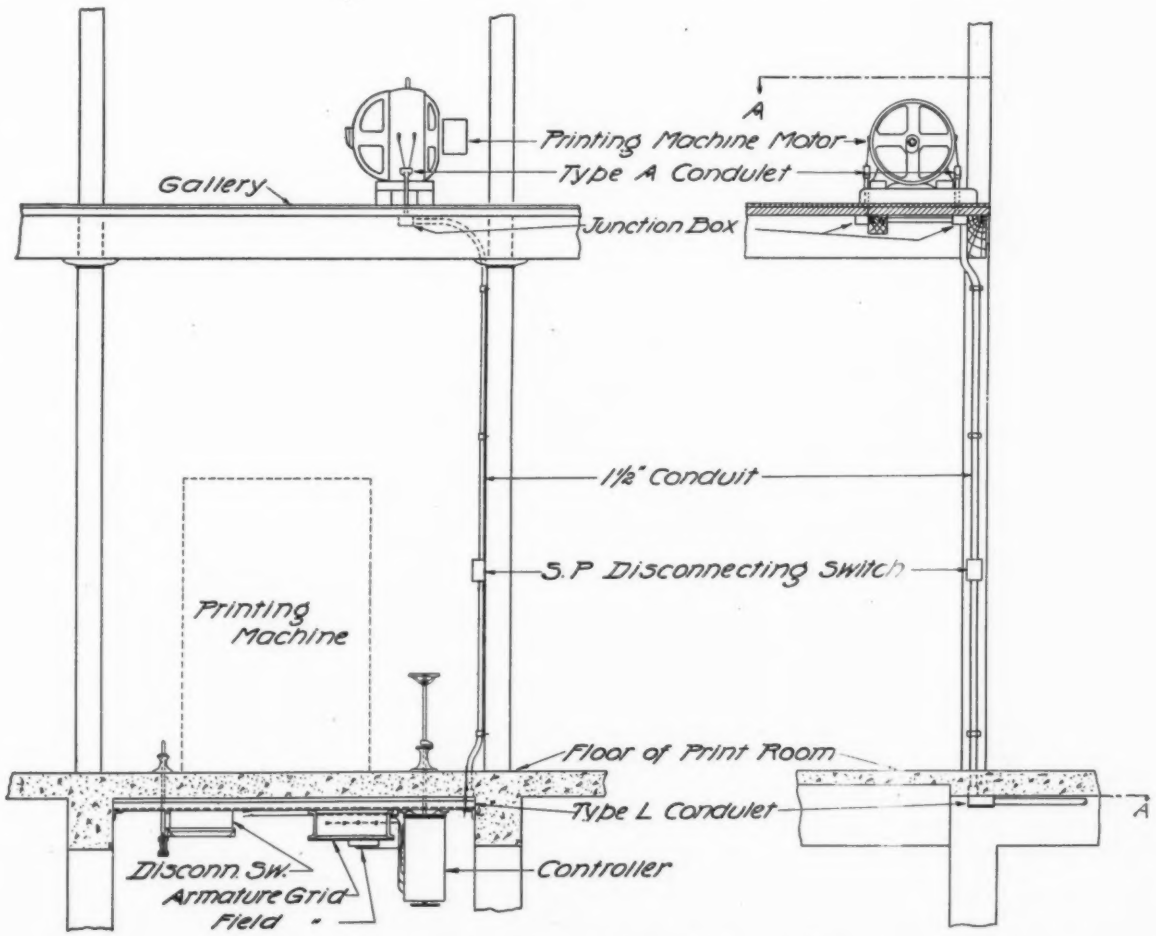


Fig. 27.—Relative Arrangement of Motors and Controllers.

from injurious overloads. It is totally inclosed in a moisture-proof cast-iron box. The mains and taps to the switch are run open. From the switch to the controller and motor the wires are run in conduit. Between the controller and the resistance grids varnished-cambric and rubber-covered wires were run open and afterwards taped together, forming a cable. The connections between controller and motor are run through the second story on the face of a column located between two machines. In this run on the column, about 6 inches from the second floor there is installed an iron box containing a single-pole disconnecting switch, connected to one of the armature leads. This switch is used when taking readings of the load on the

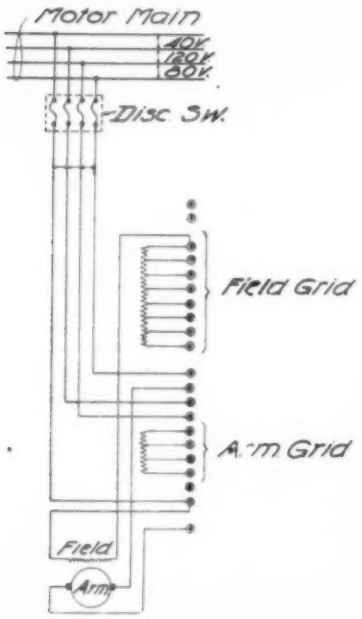


Fig. 28.—Controller Wiring.

motors, which is done once a week by means of a portable meter.

The motors for the printing machines have a capacity of 30 horsepower at 1,000 revolutions per minute.

The requirements of other adjustable-speed machinery, such as dry cans, tenters, agers, etc., are in general the same as for printing machines, except that they are less severe. As a rule, a speed variation of one to three is sufficient for these processes. For this reason the driving equipment is naturally somewhat simpler for these machines, although the general arrangement is about the same as for the printing machines.

Fig. 33 shows an arrangement with two sets of starting apparatus for tenter frames mounted on a wooden column. All the apparatus is mounted on an angle-iron frame secured to the floor and to the column. The controller (same type as used for printing machines) is nearest the floor, with disconnecting switches and resistance grids above. Switches and grids are inclosed in iron boxes so as to shut out dust. Boxes for resistance grids are provided with openings at top and bottom to allow for ventilation and dissipation of the heat, these openings being covered by a fine-meshed wire screen. The larger box directly in front contains a special four-pole disconnecting switch, which enables the entire apparatus to be disconnected from the system; the smaller box contains a single-pole disconnecting switch connected in one of the motor armature leads as described for printing machine. The large boxes on the sides contain the resistance grids. The one to the left in the picture belongs to the apparatus mounted on the opposite side of the column, while the one to the right connects with the starter in front. The reason for mounting these grids in this position was to get them out of the way of the trucks which are used for moving the cloth between the different sections.

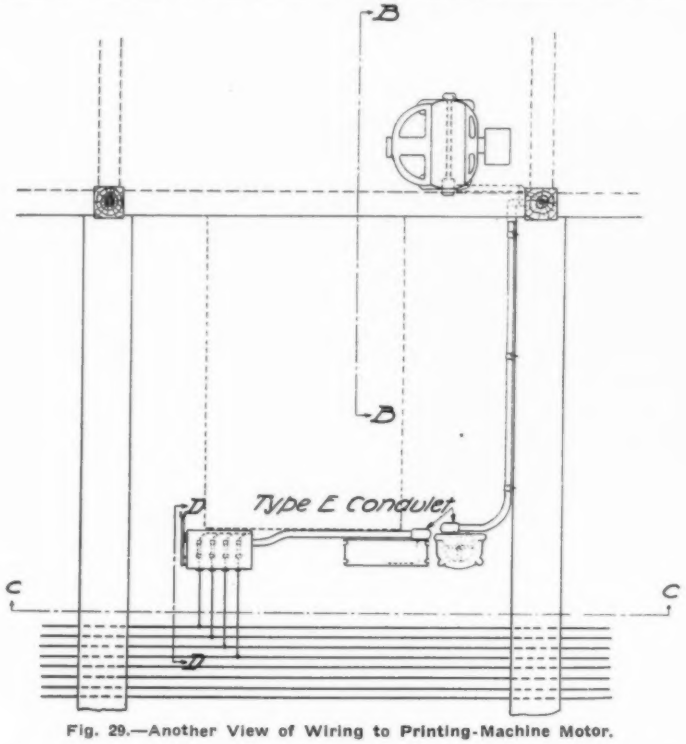


Fig. 29.—Another View of Wiring to Printing-Machine Motor.

As seen from the picture, all wiring connections between the different parts are run entirely in conduit.

Fig. 32 shows the starting apparatus for a constant-speed direct-current motor. In this case an ordinary starter, shown at the bottom of the picture, is used instead of the controller. Boxes above contain two-pole line disconnecting switch and single-pole testing switch

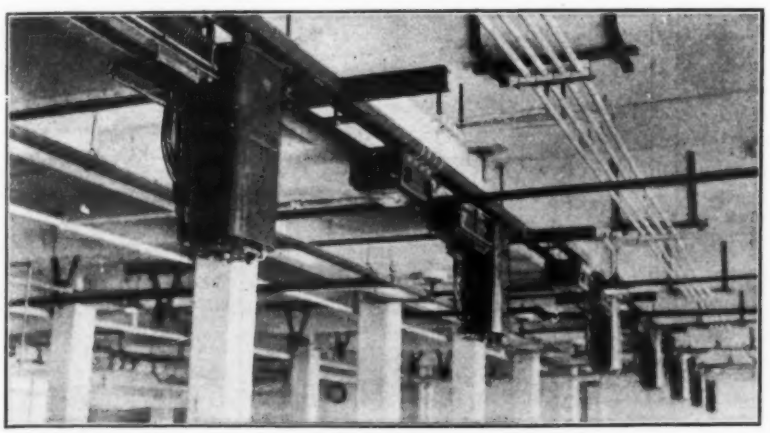


Fig. 30.—Controller Resistance Units in Position on Ceiling.

as described for the multivoltage system. The apparatus is mounted on an angle-iron frame on a wooden column. All wiring is in conduit. The picture illustrates a good example of the adaptability of conduit fittings and the neatness secured by a systematic use of such fittings.

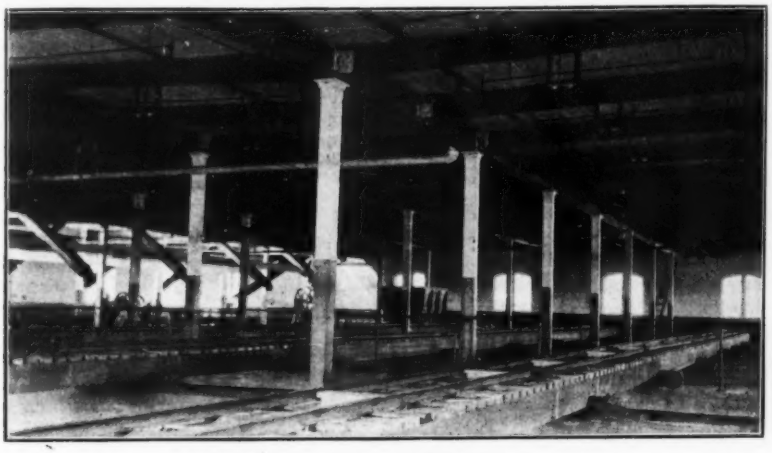


Fig. 31.—Upper Portion of Coal Pocket.

Table I gives the capacities and speed requirements of motors on the multiple-voltage system.

As all the motors are belted to the machines which they drive, the speeds given in the table do not indicate the actual speeds of the productive machinery, but merely the relation between minimum and maximum requirements.

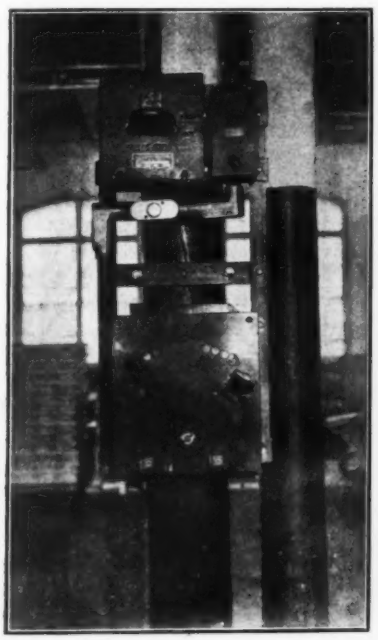


Fig. 32.—Constant-Speed Motor Starter.

Fig. 31 is a view of the upper portion of the coal pocket. It shows in the background the bucket conveyor by which the coal is carried from a hopper in the yard near the building to the upper part of the coal pocket and distributed by means of chutes to nearby compartments. This bucket conveyor is driven by a 15-horsepower constant-speed direct-current motor. To carry the coal to compartments at some distance from the line of the conveyor a trolley car is used. The conveyor empties into this car and an operator can drive to any part of the building on a system of tracks which show in the picture. The five-horsepower motor which drives this car obtains its energy from a double-pole trolley system which is installed on the beams of the ceiling as shown.

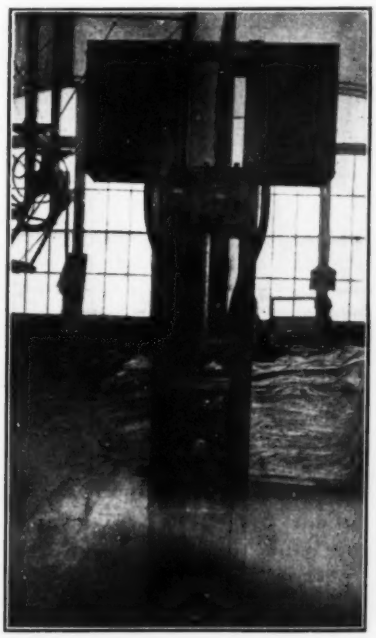


Fig. 33.—Controlling Apparatus for Tenter Frame.

Lighting System.

(a) Primary Distribution. All of the energy for lighting is taken from the 2300-volt alternating-current busses on the switchboard in the turbine room.

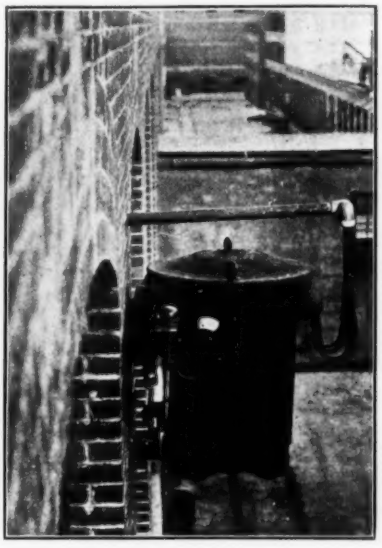


Fig. 34.—Lighting Transformer.

From this point three-phase circuits are run through basements and tunnels to groups of single-phase transformers located as previously shown. Each such circuit is controlled by an automatic oil circuit-breaker equipped with instantaneous trip coils; indicating wattmeters show the momentary load and watt-hour meters register the amount of energy supplied by each circuit, which amount is charged weekly or monthly to the accounts of the different departments.

TABLE I.

Process.	Horsepower of Motor.	Speed of Motor.
Printing	30	to 1300
Dry Cans	20	300 to 900
Soapers	20	300 to 900
Steamers	20	300 to 900
Tenters	10	300 to 900
Agers	5	450 to 900

Fig. 35.—Another View of Transformer Installation.

All wiring between switchboard and transformers is done with triple-conductor lead-covered cable run in iron

conduit. Cables enter and leave conduits through condulet fittings. All the primaries of the transformers in the different groups are connected delta.

All transformers, except those for the power house, are hung on the outside walls of the building. The method em-

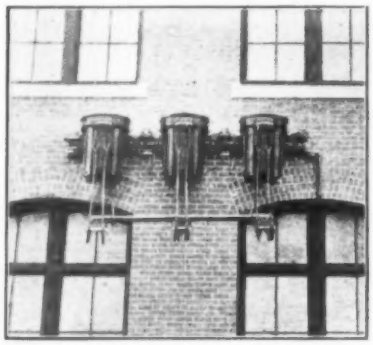


Fig. 36.—Bank of Lighting Transformers.

ployed in installing these transformers is shown in Fig. 38, which is a detail drawing of the arrangement with one single-phase transformer. As will be seen from this drawing, no wood of any kind is used in the construction; even the ordinary hanger iron is done away with. The arrangement presents a very neat appearance, and it is evident that the construction must be very strong and durable. Figs. 34 and 35 show views of single-phase transformers installed in this manner. Fig. 36 shows a group of three single-phase transformers installed in a similar manner.

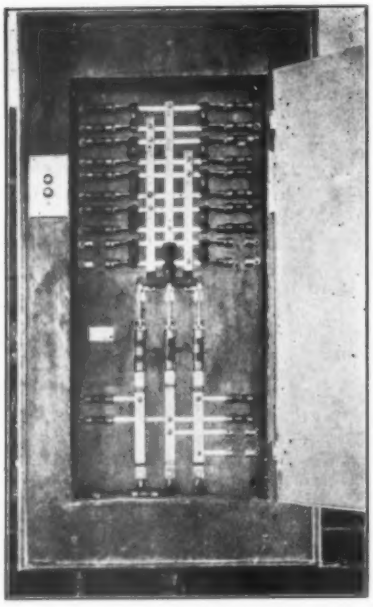


Fig. 37.—Cutout Cabinet.

This is the group for the office building.

The transformers are hung on the level of the ceiling of the second story. This location makes an approximately even distribution of the load on the risers. They are so spaced that the load from one-third of the building will come on each transformer.

Altogether there are installed 21 transformers on the lighting system, ranging in size from 10 kilowatts to 25, and having an aggregate capacity of 360 kilowatts.

(b) General Secondary Distribution. As mentioned above, all transformers are of the single-phase type. The voltage ratio is 2,300 volts primary with 230 and 115-volt secondaries.

With the exception of the office building and the power house, all secondary mains between transformers and the various distributing cabinets are run single-phase, three-wire. Through this arrangement a great saving in copper was realized. There are two reasons for this: (1) the circular-mil capacity of each main could be made the smallest possible, and (2) the lengths of the secondary runs could be kept down to a minimum.

This system of distribution could not be used in the office building and the power house because of the difficulty of balancing the load, as will be explained in detail later on in this article; also, the character of the buildings was not such as to not afford an opportunity for the installation of several risers. The secondary mains in these buildings were therefore made three-phase, the voltage being 115.

All risers and wires between transformers and cabinets were run in conduit. Cabinets were made of sheet steel, with gutters of liberal size to allow for crossing of wires and entering of conduits. The mains were connected to each cabinet through a main switch, by the operation of which all the circuits fed from each cabinet can be controlled simultaneously.

Fig. 37 shows a typical distributing cabinet for lighting. The push-button switch in the architrave controls pilot lights.

Branch-Circuit Wiring.—All branch circuits are two-wire circuits and are ordinarily run back to the cabinets, where they are protected by inclosed fuses and controlled by individual switches. With this arrangement almost any group of lamps can be controlled independently of all others. In some cases, however, submains are run from the cabinets and from these submains tap circuits are taken off, protected by fuses installed in iron boxes or conduits located on the ceiling.

Most of the branch-circuit wiring was

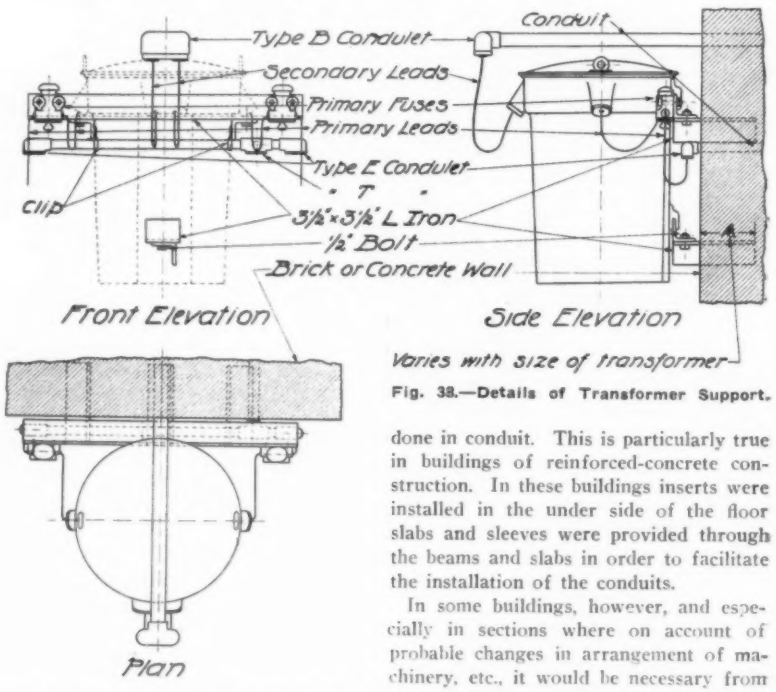


Fig. 38.—Details of Transformer Support.

done in conduit. This is particularly true in buildings of reinforced-concrete construction. In these buildings inserts were installed in the under side of the floor slabs and sleeves were provided through the beams and slabs in order to facilitate the installation of the conduits.

In some buildings, however, and especially in sections where on account of probable changes in arrangement of machinery, etc., it would be necessary from time to time to change location of outlets or the general arrangement of the wiring, open wiring was installed. This applies principally to buildings of ordinary mill construction. Here submains were run from the cabinets, these mains being of slow-burning wire mounted on porcelain cleats and passing through the timbers in porcelain bushings. From these mains tap circuits are taken off as described above. For each lamp a fuseless rosette is installed on the ceiling and from this rosette a No. 16 reinforced slicked cord extends to the socket. A Swan bushing in the top of each socket relieves the contact screws from all undue strain.

(To be continued.)

LETTERS TO THE EDITOR.

Permissible Load on a Branch Circuit.

To the Editor:

In the editorial in your issue of June 21 headed "Permissible Load on a Branch Circuit" you mention that it is not so clear why the load on a branch circuit is limited to 660 watts when the carrying capacity of No. 14 wire is 12 amperes. I have always thought that the principal reason for this restriction was that the fixture wire is in most cases No. 18 and seldom larger than No. 16. Since the fixtures are really the weakest part of the interior construction the low maximum allowed on one circuit protected by a single pair of fuses is specified so that these fuses will be sufficiently small to offer protection for the fixture wire or drop cords. No. 16 wire might be used for the circuit wire except that it is not mechanically as good as No. 14. I think one step in the right direction would be to use nothing smaller than No. 16 on fixtures.

GEORGE J. KIRCHGASSER.

Milwaukee, Wis., June 23, 1913.

The Use of Approved Fuses Will Reduce the Cost of Insurance.

To the Editor:

When a man buys insurance he must know absolutely that the company which will carry his risk is able to meet all the conditions of his policy. Should, however, the policy issued by the insurance company prove worthless through lack of capital, mismanagement, or through any other cause, and the purpose of the policy be defeated, the insured must stand the loss, if loss occurs. The same principle applies with reference to the use of approved fuses. If it is necessary to protect apparatus at all by the use of fuses, then only such fuses should be used as will successfully meet all the requirements of the National Electrical Code. That code is the consumers' insurance policy against burned-out apparatus, personal injury, fire or dangerously overloaded circuits. Its every rule is drawn by trained, able men, just the same as the terms of an insurance policy are drawn by competent attorneys. These trained men and the insurance company's attorneys have the same object in view, as they carefully consider in the one case the high standards of efficiency electrical devices should have, and in the other case, the requirements of a satisfactory policy, and both have in mind the sole object of ample protection. That protection is assurance to the buyer of insurance that he will be remunerated if he has financial loss and to the buyer of approved fuses that he will receive absolute protection for his property and his employees.

Every requirement of the National Electrical Code is most carefully considered by the best men in the country—men with high ideals, who demand the best in electrical construction, both in workmanship and in materials; that make construction not only safe from fire, but, too, safe to mankind.

The writer is sure that if everyone realized how dangerous a fuse is if an improper or badly designed element is used, no one would think any more of using an unreliable unapproved fuse than he would of carrying insurance he knew was worthless.

If the public would co-operate in refusing to use any materials which in themselves are dangerous and which are not approved by the Underwriters' Laboratories, the cost of good insurance must necessarily tend to come down because of the elimination of a large part of the hazard.

B. D. HORTON.

Detroit, Mich., June 30, 1913.

Among the Contractors.

The James Clark, Jr., Electric Company, of Louisville, Ky., has the contract for the work of providing the transmission line from the power plant of the State of Kentucky at Frankfort to the Governor's mansion in the same city.

The White City Electric Company, of Chicago, has secured a contract to wire a building at 3615 Iron Street, Chicago, for 700 incandescent lamps.

A contract just secured by Emmons & Company, of Chicago, calls for the installation of the wiring for 600 incandescent lamps in a building at 1340 Buckwood Avenue, Chicago.

The Ames Saving Bank, of Ames, Iowa, has recently let the contract covering the electrical equipment for its new bank building to C. B. Nelson, of Ames. The building is to be very complete in its electrical appointments. The system of wiring is to be knob-and-tube work, except the outside wiring, which will be conduit construction.

C. J. Trappe & Company, of Homewood, Ill., has recently wired 28 residences, the First National Bank Building, and the Lutheran Church building, all at Beecher, Ill. The latter two jobs were entirely in metal molding. Fixtures were included in all of the above mentioned buildings.

The firm of Trester & Sorgel has recently doubled its floor space, at 47 Oneida Street, Milwaukee, Wis., and has greatly enlarged its facilities for doing armature winding and all sorts of dynamo and motor repairing, in both alternating-current and direct-current work.

The new building of the St. Joseph Hospital, in Chicago, will be wired by Kohler Brothers, of that city. The installation will amount to 1,000 incandescent lamps.

L. H. Lamont, of Chicago, will do the electrical work in the new G. B. Swift School in that city, which will include 600 lamps and circuits for power.

R. G. Littler, of the West Coast Engineering Company, Portland, Ore., will leave Portland on July 7, for Chattanooga, Tenn., as the delegate of the Oregon Electrical Contractors' Association to the convention of the National Electrical Contractors' Association, which meets at Chattanooga on July 15 for four days. Mr. Littler is president of the Oregon Association and is also one of the directors of the National body. It is the intention of the delegates from the West to urge the convention to meet at San Francisco in 1915 during the Fair. The Oregon electrical contractors have a most progressive and substantial organization, and are doing a great deal of good generally for their members in the way of distributing data regarding their particular business, credit information, and things which, in general, count for the uplift of the electrical game. Mr. Littler will be accompanied by Mrs. Littler and they will visit Washington, D. C., New York, and many other points before returning to Portland.

The Ames Engineering Company, Ames, Iowa, has received a contract for the complete electric equipment for the home of J. O. Kalsem, on a farm near Huxley, Iowa. An outbuilding will house a 1.8-kilowatt, direct-current dynamo, driven by a gasoline engine. A storage battery, lighting equipment and motors are included.

Among the contracts for electrical work recently received by the Herman Andrae Electrical Company, of Milwaukee, are the following: the wiring in the new Dixon National Bank, Dixon, Ill.; the new Escanaba Hotel at Escanaba, Mich.; the Billings (Mont.) and the Livingstone postoffice buildings; the new postoffice building at Tifton, Ga.; and an installation of three large motors at the plant of the American Milk Company, at Whitewater, Wis.

The Steinmetz Electric Company, of Chicago, has just secured the contract for wiring a new building on Bryan Avenue, in this city, for 500 lamps.

National Association of Electrical Inspectors.

THOMAS HENRY DAY, president, 59 Deerfield Street, Hartford, Conn.
H. S. WYNKOOP, vice-president, 13 Park Row, New York, N. Y.
WILLIAM LINCOLN SMITH, secretary and treasurer, Concord, Mass.
JAMES E. COLE, Representative on Electrical Committee of National Fire Protection Association, 11 Wareham Street, Boston, Mass.
J. E. LATTA, assistant secretary, 608 South Dearborn Street, Chicago, Ill.

Executive Committee:

EUGENE N. DAVIS, chairman, Brookline, Mass.

Frank R. Daniel, R. P. Strong, Henry A. Knight, C. H. Fletcher, Washington Devereux, James B. McCarthy, James H. Fenton, R. J. Forsyth, C. W. Mitchell, A. W. Hopkins, G. W. Perry, George L. Collison, T. H. Fritts, A. H. Soper, T. W. Bowry, F. G. Hartwell, A. A. Moffitt, Thomas D. McColl

Secretary's Message.

The Secretary has received notice of a change in the address of Frank R. Daniell, member of the Executive Committee. He is now to be found at 76 West Monroe Street, Chicago.

F. L. Warner will be found, until further notice, at 405 Boulevard, Rockaway Beach, L. I.

The Secretary's address for the summer (after July 4) will be R. F. D. 78, West Harpswell, Me.

Members who attended the convention at New York in March will remember that a committee was to be appointed to consider changes in the Articles of Association and By-laws. That committee has been appointed by President Day as follows: Thomas H. Day, chairman; Eugene N. Davis, Fred G. Hartwell, Hubert S. Wynkoop, James E. Cole and W. Lincoln Smith.

It might appear to some that the committee as organized was rather of a local character, but previous attempts have shown that effective work cannot be done in this matter by correspondence between the committee members, and that it must be possible for the committee to meet together frequently. The committee has under consideration several very important matters which it is believed will be of great benefit to the Association and which have been suggested from widely separated points. It has held already several fully attended and fruitful meetings, and it is hoped that in a comparatively short time the results of its labors will be in shape to present to the Executive Committee as a whole, and, if approved, to the members at large.

The Secretary desires once again to state the position of this Association as regards the foundation of inspection work—the National Electrical Code. It would seem to him that some of our members, and some others as well, are not quite clear on this point, at least if some of the questions which reach him are a criterion. It is very possible that some may feel that if they had the drafting of the Code it would be quite different in places from what it is. Usually this comes about on account of some local peculiarity which does not seem to be handled just as they might like it. A little consideration will, however, I feel certain, lead any such to the honest conclusion that though the Code—like any oher human piece of work—cannot be considered perfect, yet it is really a wonderfully satisfactory tool to work with and fits itself to the demands made upon it in daily work throughout the country with remarkable adaptability.

The matter appearing in this section consists of questions on the National Electrical Code, its interpretation and meaning, and questions as to whether certain methods of wiring are in accord therewith. These questions are gladly received from anyone interested, even if not a member; they should be sent to the secretary with any needed elucidating sketch. They are answered by each member of the Executive Committee according to his knowledge of what the ruling would be in his jurisdiction.

It should be understood that no pretense is made to give an authoritative interpretation of the Code. This is a voluntary association; it has representation on the Electrical Committee of the National Fire Protection Association, which prepares the Code, but it has no right, and claims no right, to give a final interpretation of anything in the Code. It is only intended to give the interpretation which seems correct to the members of the Executive Committee. No attempt is made to edit or correlate the answers from the different members of the Committee, as it is felt that the occasional difference of opinion is calculated to lead to a further study of the matter in question, further discussion and the final clearing up of obscure points.

The aim is to help toward a better understanding of the Code on the part of all; a more uniform conception of its meaning; increased precision in applying it; and harmonious action of those using it, for the common good.

Some questions on the Secretary's desk would lead him to believe that in spite of our inset heading some correspondents have an idea that this department of the Association's activities is available as a forum for Code criticism. *It is not.* It is intended to assist in the *uniform interpretation* of the Code *as it stands.* If anyone desires changes in the Code it is his privilege to present his criticisms and proposals to the Electrical Committee of the National Fire Protection Association, through its secretary, Mr. Sweetland, in proper form, and he may feel certain that full consideration will be given them.

This association of inspectors in the carrying on of this question work, however, stands squarely upon the Code as it comes to us from the Electrical Committee, and our great aim and desire is to assist in promoting its uniform interpretation and universal acceptance.

When such a metropolis as New York can accept the National Code with so few modifications as are found to appear in the code of that city, it means just one thing: that is, the workability, adaptability and general excellence of the Code as a standard for a municipality of any size; and this not at all neglecting the fact that in a code of such a nature there must be on the one hand a few things possibly too stringent for a small hamlet of only a few scattered dwellings and on the other not stringent enough for the requirements of a city of a million or so inhabitants. Therefore, while as another of our activities the Executive Committee is always ready to listen to any suggestions looking toward the modification of Code requirements, and if such appear reasonable, to assist in properly bringing them before the Electrical Commitee, the officers of the Association wish it distinctly understood by all interested in this work that this department exists not as a forum for the discussion of what some one might like a code to be, but that it is intended to assist in clearing up the meaning of the few doubtful clauses which may remain in the Code, to indicate how it applies to various doubtful cases and when cases arise which the Code apparently does not reach, to call attention to that fact so that the gap may be filled in the proper way.

The two questions which appear herewith are very interesting. Neither of them is covered by the Code, it seems, as it stands, but the construction asked about is obviously poor engineering, in both cases. Under certain conditions, I think I would allow

the arrangement of circuits mentioned in Question 231, but I would be very careful to explain what I thought to be its objectionable nature. Really, though, the man who has this sort of construction in his house is not very dangerously off. But one can imagine possible occurrences which might make the matter serious if the tap circuit which returned through the main conduit were protected with plug fuses instead of with inclosed fuses.

As to Question 232, I do not see how the present Code can be considered as touching the matter. An amendment was adopted last March, however, which I think might be of assistance. That is, it was voted to make the heading "Class B, Outside Work" read "Not including wiring protected by the service cutout and switch"; and similarly, further on, to add to the heading "Class C, Inside Work" the clause "Including all work protected by service cutout and switch."

Accordingly, when the new Code appears, I feel that it would be legitimate to argue that a new and distinctly sharp line was drawn between the two classes of outside and inside wiring and that I would refuse positively to permit wires that belonged to one class (Class C), as would the wires leading to the several apartments after they had passed the meters, service cutout, etc., in the cellar, to be placed in a conduit containing wires leading to the service switch and meters, which just as clearly belong to Class B construction.

Question 231. Is there any objection in the Code to placing circuit wires in the same conduit with service wires? Thus where a service enters the front of a cellar through service cutout and switch, running thence across the cellar to a meter board, is there anything to prevent carrying a loop of No. 14 wire from a branch cutout back through the main conduit and out through an approved fitting for a light near the service entrance?

Answer 1 (A). This is a question that was probably never thought of by the Code committee, and I do not think any inspector would consider it proper and wise.

Answer 2 (V). I know nothing in the rules to prohibit this form of construction, although I have discouraged it in my territory.

Answer 3 (S). I find no objection in the Code to this installation.

Answer 4 (O). The practice described would be subject to criticism from an engineering standpoint, and also from a standpoint of fire hazard, but it violates no Code requirement.

Answer 5 (Q). Only wires of the same system are permitted in one tube. See Rule 26*p*.

Answer 6 (M). I know of no rule which would prevent such an installation, but I would endeavor to have the service wires kept separate from all others.

Answer 7 (J). So far as I am aware, the Code does not prohibit the running of main and branch wires in the same conduit. Our local regulations do not allow such a construction, however; all circuits in the same conduit are required to be similarly protected, and the running of more than one circuit in any conduit is strongly discouraged.

Answer 8 (D). There seems to be no rule applying. We do not deem the question, as presented, serious.

Answer 9 (H). How do you propose to put an approved fitting into the conduit containing the service wires? There seems to be nothing in the Code to prevent carrying approved wires back through the conduit containing service wires provided the voltage is not over 300 and the wires themselves are properly insulated.

Answer 10 (P). No.

Answer 11 (F). There is no specific rule in the National Electrical Code to prevent this method of construction. In this jurisdiction we would not care to approve such an installation, owing to the possibility of a breakdown of insulation between the service and branch circuit wires, in which case the service cutout and switch would become useless.

Answer 12 (R). There is no objection in the Code to placing circuit wires in the same conduit with the service wires. Rules 26*p* specifies the number of circuits to be run in one conduit. It is not, however, considered good practice in this territory to use the service conduit for other than the service wires.

Answer 13 (C). There are no objections under the Code rules on this point. I would consider it very bad practice on account of a possible breakdown in the main conduit, which would subject the circuit contained in the same conduit to the same condition back to the point where the circuit is protected with fuses. And, under Rule 23*a*, I would ask for a cutout at the point where the circuit leaves the building in the service conduit.

Answer 14 (E). I do not feel that the Code has any rule which would prevent an inspector approving this form of construction. Certainly it is within the limits mentioned in the third paragraph of Section *p*, Rule 26.

Answer 15 (I). This strikes us as a very unusual sort of construction, but we know of no Code rule prohibiting it. The service wires being provided with fuses where they enter the building, the construction would be safe, it would seem.

Answer 16 (B). No, there are no objections under the Code, but the practice is nevertheless bad.

Answer 17 (N). There is nothing to prevent such an installation in the Code as it stands at present, and, though it is very bad practice, I am unable to see how it can be prevented except by an arbitrary decision.

Answer 18 (U). I cannot find any rule in the Code which covers such a case.

Question 232. A service runs from a pole to the side of a four-story apartment house, down the side of this in pipe to the cellar, where are grouped the various meters. The contractor wishes to carry the subfeeds for the individual apartments, only one of which is at present to be used, back through the outside service pipe and out through a suitable branch outlet on each floor level into the several apartments, the fuses all to be in the basement, but a main switch in each apartment. Is this allowable? Would it be if a cutout were also placed in each apartment?

Answer 1 (B). Construction suggested would not be permissible in this city, and we do not feel that it would conform to the requirements of the National Electrical Code. The subfeeds for the individual apartments should be kept within the buildings and run in accordance with the rules for interior construction, each apartment having its own cutouts and such switches as might be deemed advisable and all wiring in building to be controlled by service switch protected by service fuses, which in the case under consideration are presumed to be located in the basement.

Answer 2 (D). We should not consider it as complying with the require-

ments of the Code to run submains in the same conduit with the service wires. In the event of a breakdown in the insulation between service and submains no protection would be available other than the primary fuse on the transformer. In the event of transformer insulation being punctured, the high voltage would readily enter through the submains without having to pass through protective fuses, or without the advantage of being disconnected by service switch. The placing of a cutout in each apartment would not offer the disired protection.

Answer 3 (S). No, is the answer to this question. Rule 23*a*, 24*a*, and 26*p*, all have a bearing on this question. The answer to the last part of the question would be the same as to the first part. The entrance fuses and switch should be in the cellar, as this is the point where the wires first enter the building. The service conduit may be used for branch circuit wires, if Rule 26*p* is complied with.

Answer 4 (C). Rule 23*a* should be complied with in this case, as the circuit wires in the same conduit with service wires are subject to the same conditions and outside elements as the service wires, and should be protected with fuses and operated with a switch where they re-enter the same building, just as service wires. The question of a cutout in each department is allowable, provided it is properly protected and controlled by the switch as called for in Rule 24*a*, not losing sight of the requirements for the number of wires in a conduit as required under Rule 26*p*.

Answer 5 (M). There is nothing in the Code to prevent such an installation, but I should object to it on the ground that a short-circuit in the service wires undoubtedly would cause trouble on the subfeeders. If trouble occurred on the service wires, due to contact with high-tension wires or to lightning, the possible number of places where fires might start would be greatly increased, even if cutouts were placed in each apartment.

Answer 6 (J). To the first part of the question I should answer no. As to the construction when a cutout is placed in each apartment, I should say that it was allowable, although in that case it is not apparent why the service should be carried to the basement at all. Moreover, a cross between descending and ascending service wires in the outside pipe might result in serious trouble at the cutout in the basement, as a single fuse here might be called upon to open a circuit of the full capacity of the transformer or station circuit-breaker.

Answer 7 (O). This service arrangement would appear objectionable from an engineering standpoint, but does not necessarily violate any Code rule, except that perhaps more than four, two-wire or three, three-wire circuits would be in the same pipe. The placing of an additional cutout in each apartment has no bearing on the matter.

Answer 8 (E). The wires being properly protected by fuses, I know of no Code rule which would be violated by this form of construction. I do not feel, however, that it is a wise form to adopt.

Answer 9 (P). The layout suggested brings the house wiring into close proximity with the outside service line, which lacks fuse protection up to the point where it enters the basement. For this reason, if the subfeeders are carried in the service pipe they must be provided with service switches and cutouts at each apartment.

Answer 10 (F). No, to (a). (b) Yes, we would approve this condition if cutout is placed at the immediate point of entrance.

Answer 11 (N). I can not find anything in the Code as it stands to prevent this unfortunate plan of wiring.

Answer 12 (V). I know of no rule to prevent doing this in either case.

Answer 13 (I). Our worthy secretary served notice on us not long ago that we were expected to answer these questions in the light of the National Electrical Code instead of giving our own opinions. It happens that this particular sort of construction is not contemplated in the Code, so far as we are able to discover. We should do what we could, if the matter were put up to us, to discourage its adoption. Perhaps we could base our ruling on Rule 26*p*; for between the basement and the first apartment there would be five two-wire circuits, or one three-wire and four two-wire circuits, or three three-wire circuits in the same conduit, and the inspector has a right to decline to permit this sort of thing. Moreover, it would not seem to be unreasonable for him to insist that the proposed scheme would amount to putting circuits of different systems in the same conduit, although the Code probably has reference to the kind of current rather than to what the circuit is to be used for when it states that circuits of different systems must not be run in the same tube.

Answer 14 (Y). The Code does not cover this question, apparently.

Danger from Stream of Water Striking High-Tension Line.

F. C. Caldwell, professor in Ohio State University, has been conducting some experiments to determine the hazard to life involved in directing a stream of water from a fire hose upon a high-tension line, and the results have been published in the *Sibley Journal of Engineering* for May. Measurements were made of the resistance of a stream of water between hose nozzle and a piece of No. 6 copper wire upon which the stream was directed. It was found that when the length of the stream exceeded a given value, in the neighborhood of 20 feet, the resistance of the stream was very large. This was due to the breaking up of the stream into separate particles of water which makes the stream nonconducting. This critical distance varies with the size of the nozzle and the pressure upon it. Since high-tension circuits are usually more than 20 feet from the ground, it is concluded that there is little danger of injury from this source, so long as the fireman is standing upon the ground. When, however, he is working from a ladder or is using a tower which would bring the nozzle into closer proximity to the wire, a dangerous shock might be received through the stream.

The resistance of the water in the hose itself was found to be about 150,000 ohms per hundred feet, so that the grounding of the nozzle through this water could not be depended upon as a short-circuit around the person handling the hose. In other words, the nozzle cannot be regarded as grounded.

What He Wanted.

One of the large central station companies recently received the following letter:

"Please have one of your representatives to call to see us within the next three days, to furnish us with a price per kilowatt, for our new plant we are erecting. We will use in line of motors five hoarse power one, three hoarse power one, four half hoarse power. And perhaps, more, we will also have three arch lights on each floor, meaning three floors. And one arch light on first floor extra, and a direct currant.

"We would also like to have a price on moters. Our aim is to see which will be the cheapest, to place a boiler or a motor for each machine."

Public Service Commissions

CALIFORNIA.

The rate expert of the Railroad Commission, James T. Shaw, has recommended, in a report, reduction of the long-distance rates of the Pacific Telephone & Telegraph Company to the extent of nearly $400,000.

An order has been issued granting authority to the Lassen Electric Company to purchase the Branham Plant at Susanville, for $4,500.

A decision was rendered granting authority to the California Telephone & Light Company to purchase the properties of the Cloverdale Light & Power Company for $75,000 in cash and $50,000 of preferred stock.

A decision has been rendered by the Railroad Commission granting authority to D. C. Gillen to sell his electrical distribution system in Colfax to the Pacific Gas & Electric Company for $12,000.

ILLINOIS.

Governor Dunne on June 30 signed the new public utilities bill previously passed by the State Legislature. Before final passage this bill had a provision for home rule by municipalities stricken out, so that all public utilities come under the jurisdiction of the Commission. The Commission will consist of five members, each receiving a salary of $10,000 a year. The jurisdiction of the Commission covers accounting, issuing of securities, mergers of separate utilities, regulation of rates and service, investigation of accidents, etc. The present Railroad and Warehouse Commission is abolished and its duties transferred to the new commission. No provision is made for indeterminate franchises and no control is given to the Commission over municipally owned utilities.

At the same session a bill was passed authorizing cities to acquire, construct, own and operate public utilities.

MASSACHUSETTS.

Governor Foss of Massachusetts has appointed the following members of the Public Service Commission: Frederick J. Macleod, Cambridge, for five years; George W. Anderson, Boston, for four years; George P. Lawrence, North Adams, for three years; Clinton White, Melrose, for two years; George W. Bishop, Newton, for one year. Messrs. Macleod, Bishop and White constitute the present Railroad Commission. The members choose their own chairman. The chairman will receive $8,500, and the other members $8,000, annually.

NEW YORK.

On July 7 the Public Service Commission for the First District will begin an inquiry to determine whether the New York Edison Company has violated the order made by the Commission in December, 1908, prohibiting discrimination in rates and contracts. The Commission recently dismissed the complaint of Frankel Brothers, alleging that the Company refused to supply them with break-down service because they supplied current from their private plant to another building which formerly was supplied by the Edison Company. Frankel Brothers asked for a rehearing, but the Commission denied the application. However, the complainants alleged that the Edison Company is supplying break-down service to the St. Nicholas Rink and Healey's restaurant, where the same conditions exist as with Frankel Brothers and the building which they supplied. To ascertain whether the Company is violating the Commission's order in providing such service, the Commission ordered the inquiry.

The Flatbush Gas Company has been granted special permission by the Commission to put into effect, seven days after publication, a supplement to its schedule of rates for power purposes. The new supplement gives a schedule of discounts to be allowed on monthly bills ranging from 20 per cent on quantities between 100 and 200 horsepower-hours and 83.33 per cent on quantities in excess of 80,000 horsepower-hours. In its application the company states that recently it had a request from an ice manufacturer for the supply of electric current for power purposes in quantities so large that it is necessary to extend the old scale of discounts to make an attractive rate to the prospective consumer.

The Commission has ordered a hearing to inquire into the conditions of the cars operated by the New York and Queens County Railway Company. Clifton W. Wilder, electrical engineer of the Commission, states that the company has not conformed to the order to put its cars in first-class condition.

OHIO.

The Public Service Commission has approved the sale by H. H. and M. F. Smith to the Lexington Light & Power Company of the electric lighting plant located in Lexington. The company is authorized to issue capital stock to the amount of $1,050, of which $1,000 is to be paid for the plant.

OKLAHOMA.

In the case of R. S. Bristow vs. The Comanche Telephone Company, the complainant alleged that the telephone service at Comanche was extremely poor, especially at night, when a boy was put in charge of the board and allowed to sleep in the office, and that a charge of 25 cents was made for all calls on rural lines and that the company could easily afford to give free service on such lines. The Corporation Commission decided that the allegations of the complaint were in the main true and that there should be free and unlimited service from the city to the rural lines, with no greater charges for long-distance service than are charged by other lines for like service. The company was ordered to have capable and efficient operators for both day and night service.

In a complaint filed against the Independent Telephone Company, of Cestos, one subscriber testified that for apparently personal reasons it was impossible for him to get a telephone installed by the company. The Commission ruled that service should not be denied to any person desiring to become a subscriber so long as the applicant meets the conditions set down by the company.

In the case in which George A. Davenport and other residents of Soper, Choctaw County, are complainants, the Commission ordered the Pioneer Telephone Company to give long-distance connection with the Choctaw Telephone Company at Soper and to discontinue its connection with the Citizens' Telephone Company of that place. It was ordered further that the Citizens' Company be permitted to connect with the Choctaw Company at Soper, and calls originating on the former's lines will be handled by the Choctaw Company on a basis of 25 per cent. The Citizens' Company is required to handle business from the other company on the same basis.

American Institute of Electrical Engineers.

Report of Thirtieth Annual Convention, Cooperstown, N. Y., June 23-27.

The thirtieth annual convention of the American Institute of Electrical Engineers was held at the Otesaga Hotel, Cooperstown, N. Y., on June 23 to 27 inclusive. The total registration at the convention was 239.

The hotel forming the headquarters for the convention was delightfully situated at the foot of Otsego Lake, and except for rain during the latter days of the convention, the weather was delightful and added greatly to the success of the occasion. The entertainment features which had been prepared by the Committee and which are mentioned in detail later added greatly to the enjoyment of all present.

Opening Session.

The first session of the convention was opened by President Ralph D. Mershon at 10:35 Tuesday morning. Upon the platform were Vice-presidents Rushmore, Stone and Sprong, Secretary Hutchinson, and Honorary Secretary Ralph W. Pope.

President Mershon devoted his opening address to the results of his experience gained as an officer. He spoke of the necessity of appointing new technical committees as the art develops and the desirability of holding meetings under the auspices of the local sections. These developments of Institute activity are limited, however, by the expense involved, and it is necessary to raise the income of the Institute, curtail its activities or cut down expenses. He considered the latter the only desirable proceeding and it could be accomplished by doing less printing and sending copies of papers only to members who are interested in them. As it is now, every member receives two copies of each paper since the bound *Transactions* includes all of them. From the standpoint of expense the new societies, whose organization has been deprecated by some, are not an unmixed evil.

The economics of engineering is now receiving greater attention than formerly, as engineers are taking a wider viewpoint of the subject.

Section work is now enlarging and he considered it desirable to have technical committees appointed in each section. Wider representation on the Board of Directors could be secured by increasing the number of directors. It is desirable to give greater publicity to the proceedings of the Board, so that the membership can take a closer interest in Institute affairs.

Mr. Mershon did not favor following precedent too closely where it could be improved. In this connection he did not sympathize with the deprecation of the seeking of office by members, as it was proper that members who had shown interest in Institute affairs and worked for it should look forward to recognition by election as officers. He believed further that the requirements for membership should be closely adhered to and the standing of the Institute carefully guarded.

This address was greeted with prolonged applause.

The president then introduced C. O. Mailloux, the president-elect, who made an appropriate response, advocating among other things that engineers should concern themselves not only with technical questions but with civic, social and humanitarian problems. He felt that the members generally agreed with the ideas advanced by President Mershon, as was evidenced by the reception given to his address.

The president then announced the inability of Elihu Thomson to be present on account of poor health, and upon motion, supported by an unanimous vote, a telegram was ordered to be sent to him expressing the good wishes of the members and guests at the convention.

After announcements regarding the program of the convention, a paper was presented by William McClellan entitled "A Suggestion for the Engineering Profession." After pointing out the historical development of the engineer and the specialization which has been shown in recent times, resulting in a lack of unity among engineers, this paper advocated the formation of a national association made up of representatives from national societies of professional engineers which would represent the entire body of engineers in all national and public matters. Society needs such help in connection with conservation discussion, appointments to public commissions and offices, advising on legislation, etc. An outline for the organization of such a society was presented.

This suggestion was very well received and resulted in a motion, which was carried, referring the proposition to the Board of Directors for consideration. The discussion was opened by C. O. Mailloux and continued by Oberlin Smith, C. L. Clark, D. B. Rushmore, C. L. de Muralt and D. C. Jackson. Mr. Smith, who is a member of the four principal national engineering societies, stated that he had found a similar sentiment among the civil engineers and thought they would be ready to co-operate. Professor Jackson called attention to the definition of an engineer and thought the scope of the new organization should be wide enough to agree with this definition.

Telephony.

The president then called upon F. F. Fowle to occupy the chair during the presentations of the papers on telephony. The first of these was by A. E. Kennelly and F. W. Lieberknecht and was entitled "Test of an Artificial Aerial Telephone Line at a Frequency of 750 Cycles Per Second." In the absence of the authors this was presented in abstract by E. H. Colpitts.

This paper described experiments upon an artificial telephone line made up of the same units described in a paper at the 1912 convention. With the addition of suitable resistances in each section, this was made equivalent in its properties to a typical telephone line 500 miles long. Measurements of voltage and current were made by means of a Drysdale alternating-current potentiometer and a vibration galvanometer. The potential applied did not exceed 1.8 volts and observations were taken at the end of each section with the line open at the far end and with it grounded. Hyperbolic notation was used in the paper to represent the various quantities concerned and the results plotted in circular co-ordinates.

This paper was discussed by F. K. Vreeland and D. C. Jackson.

H. M. Friendly then presented a paper by himself and A. E. Burns entitled "The Adaptation of Automatic Methods to Long-Distance Telephone Toll Switching." This described the equipment used by the Northwestern Long Distance Telephone Company to improve the traffic capacity of operators, lines and equipment. The personal equation in this work has been a potent factor in determining the efficiency, and any equipment that will reduce the uncertain element is fully warranted, regardless of its complexity, if it be dependable. This equipment eliminates the through operator at intermediate switching offices. The longest line equipped for automatic operation is from Corvallis to Portland, Ore., a distance of 96 miles. Equipment was also described for enabling connections to be established in automatic local exchanges from distant points and for enabling a toll operator to call subscrib-

ers directly in a distant manual local exchange without restricting the normal uses of the toll line. Reliability of action was the first consideration in devising the equipment and cost was a secondary consideration.

This paper was discussed by John B. Taylor and Oberlin Smith.

Albert F. Ganz, chairman of the Electrochemical Committee, was then called to occupy the chair during the presentation of a paper entitled "Electrolytic Corrosion of Iron in Soils," by Burton McCollum and K. H. Logan. This was presented by Mr. McCollum and discussion postponed until the next session.

Electrolytic Corrosion of Iron in Soils.

This paper deals with the fundamental laws governing electrolytic corrosion of iron in soils. Experimental data are given showing the effect of the different factors that are most likely to influence electrolytic corrosion of buried pipes under practical conditions, such as current density of discharge, moisture content of the soil, presence of oxygen, temperature, voltage, and other factors. The effects of earth resistance, polarization, and surface film resistances are also discussed briefly, and tables given showing the results of specific-resistance and corrosion tests on a large number of soils taken from widely scattered sources, which give an idea of the order of magnitude of the values of resistance and corrosion efficiency that may be expected under average practical conditions. The following conclusions are presented showing briefly the effect of the different variables involved and their relation to some practical aspects of the subject of electrolysis: (1) The current-density has a marked effect, the efficiency of corrosion being in general greater the lower the current-density. In saturated soils the corrosion may vary between 20 per cent and about 140 per cent for the range of current densities between 5 and 0.05 milliamperes per square centimeter. (2) Moisture content in the soil also has a marked effect, the corrosion efficiency being greater with increasing moisture. (3) Temperature changes within the limits commonly met have no important effect. (4) The depth of burial of pipes has no direct effect on corrosion efficiency. In practice, however, the moisture content, current carried by the pipes, and various other factors which affect corrosion efficiency will vary with depth. (5) The amount of oxygen present has no appreciable effect. (6) Corrosion of iron imbedded in earth is always greater in open than in sealed vessels. (7) The amount of oxygen present has a marked effect on the end products of corrosion. If the corrosion is rapid and the supply of oxygen small, there will be a preponderence of magnetic oxide, while if the rate is low and the supply of oxygen abundant the ferric oxide will predominate. Owing to the fact that the supply of oxygen around the pipes buried in earth is always more or less limited, the character of the oxides formed gives some indication as to the rate of corrosion, and thus indirectly as to the cause of the corrosion, if local conditions are properly considered. (8) There is no material difference in the efficiency of corrosion shown by the various kinds of iron commonly used in the manufacture of underground pipes. (9) The fact that a given chemical tends strongly to inhibit either corrosion in liquids is no indication that it will materially retard electrolysis of iron imbedded in soils. (10) Pitting of iron imbedded in soils is affected not only by a non-homogeneous condition of the iron or soil, but also by the chemicals contained in the soil. (11) The efficiency of corrosion was found not to be a function of the voltage except in so far as the current-density may be affected. (12) Corrosion tests on a large number of different kinds of soil indicate that corrosion efficiencies between 50 and 110 per cent may be expected under practical conditions. (13) The resistance of soils varies throughout a very wide range with variations in moisture. (14) Because of the great variations in resistance of earth with moisture, voltage surveys should not be made at times when the earth is extremely dry. (15) The resistance of the soils varies greatly with temperature within the ordinary range encountered in practice. At freezing temperature the resistance will be several times that at summer temperatures. (16) As corrosion efficiency decreases at high current-densities it is undesirable to penalize high voltage peaks of short duration where voltage drop is limited to prevent electrolysis.

The session on Tuesday evening was called to order by President Mershon, after which Albert F. Ganz, chairman of the Electrochemical Committee, took the chair during the discussion of the paper by Messrs. McCollum and Logan, which had been presented at the morning session.

C. L. Clarke read some written discussion which had been prepared by J. L. R. Hayden. The latter had found in his work a decrease in the efficiency of corrosion with increasing current-density. Such an increase, even though only momentary, helps to produce passivity of the iron. The lack of electrolyte also tends to produce passivity.

D. C. Jackson referred to the effect of moisture on soils and stated that the changes in soil resistance explained differences frequently observed where all other conditions are alike. Temperature is of importance owing to the fact that frozen soil is a nonconductor. In winter time there is frequently less current in the ground to cause corrosion because the ground is frozen at least on the surface near the rails. In his experience cast iron did not corrode as fast as wrought iron. He presented figures typifying the loss due to gas leakage in cities of different sizes and pointed out that the economic solution of electrolysis troubles is to balance the cost of the injury against the cost of preventing it.

H. T. Wreaks pointed out that the experiments described were with uncoated pipe and inquired whether any results were available with coated pipes.

H. V. Bozell stated that in Oklahoma the gas and electric plants were frequently operated by the same companies, and hence any damage caused in the gas pipes by electrolysis is suffered by the company responsible for it. In many cities the gas mains are run in parallel along both sides of the street and it is found that under these conditions there is very little corrosion.

F. C. Caldwell pointed out that it might not be wise for a municipality to set a limit of allowable voltage, since this might relieve the railway company from responsibility for any damage done by voltages within this legal limit.

Harry Barker, J. C. Lincoln and H. G. Stott also joined in the discussion.

Alexander Maxwell presented written discussion which was read by Professor Ganz. He considered the most important feature of the paper the relation which was shown between current-density and efficiency of corrosion and presented some average values which had been actually found in city streets where the pipes had suffered. These values ranged from 0.0005 to 0.04 milliamperes per square centimeter. Corrosion above the theoretical value was sometimes experienced at low current-densities.

A. F. Ganz had also found in his experience that there was less corrosion when the current-density was high. High values had been experienced by him where the current computed was from 0.02 to 0.05 milliampere per square centimeter with a drop of one volt and 0.01 to 0.15 where the drop was five volts. If the current is concentrated at particular points six months might be sufficient to corrode a pipe entirely through.

In closing the discussion Mr. McCollum stated that a concrete roadbed will increase the resistance over the value with ordinary soil. Even when concrete is watersoaked the resistance is 10 to 20 times that of the best conducting earths. He stated that a report was in preparation dealing with coated pipes. Few pipe covers have any value for this purpose, since they tend to concentrate the corrosion at any point where the coating may have been chipped off, and thus localize the corroding effect. The best coating he knew of is a thick layer of pitch. The value of enamel depends upon its mechanical properties and the fact that it is waterproof. If it is not waterproof there will be local action resulting in the splitting off of the enamel. The scheme of running parallel gas mains on both sides of the street is good, but is not sufficient in itself to entirely avoid damage. Experiments with alternating current at various frequencies

showed a loss of not more than one or two per cent of that with direct current, and when direct current is reversed frequently the corrosion is much less than when it is continuous in one direction. High resistance at joints may have a secondary value in reducing electrolysis. On the other hand it may produce damage at the joint itself due to the large drop of voltage at this point. He considered insulated negative return feeders very desirable since they reduce the drop more than bare copper cables in parallel with the earth.

Educational Session.

The remainder of this session was under the auspices of the Educational Committee, which had arranged a symposium on "Industrial Education." In the absence of the chairman of this committee, Walter I. Slichter presided at the meeting and presented a brief report for the Committee, giving a synopsis of its work.

F. C. Hendershott then presented a paper entitled "The National Association of Corporation Schools." This explained the objects and conditions of membership of this body, which was established at a meeting held in New York City on January 24. The movement already includes corporations employing over 500,000 employees and representing a capitalization in excess of $3,000,000,000. A list of the Class A charter members is given. The first annual convention will be held in Dayton, O., September 16 to 19.

A paper by A. J. Rowland entitled "Vocational Education in Philadelphia and Vicinity" was also abstracted by Mr. Hendershott. After stating the general conditions existing in Philadelphia with respect to evening classes and the methods used to meet the problems encountered, examples were given of the courses presented by the various educational institutions concerned with this work, of which there are about a dozen.

J. W. L. Hale then presented a paper by himself and John P. Jackson entitled "The Pennsylvania Railroad Company Apprentice Schools." This explained the purposes and aims of the courses given and an outline of the work. Schools are now maintained in Altoona, Philadelphia and Harrisburg, Pa., and Wilmington, Del. The work covers three years of 42 weeks each, while the apprenticeship course is for four years, the last year not including any school work. Experience has shown that the use of proper principles of pedagogy in work of this kind is just as important as in any other school work.

These papers were discussed by C. L. Clarke, H. G. Stott, M. T. Crawford, J. W. L. Hale, N. J. Neall, J. L. Wayne, III, A. M. Buck, F. C. Caldwell, H. M. Friendly, George C. Shaad, O. J. Ferguson, Comfort A. Adams and Harry Barker.

Mr. Clarke emphasized the need of teaching good English composition along with vocational studies. Mr. Stott considered the keynote of success to be to carefully train men to the best use of their abilities without creating aspirations that can never be realized. There is a danger of setting up false ideals and wrong ambitions. Mr. Crawford told of the instruction for evening students in the university cities of the Far West. The element of personality in instructors was emphasized by several speakers and the effect of this upon Mr. Stott's point indicated. Professor Caldwell called attention to the societies now in existence for vocational guidance, which is necessary outside as well as inside large corporations. Mr. Friendly pointed out the importance of encouraging the reading of technical magazines, which is often neglected not only by shop men but by college graduates.

Professor Adams said that each man should be trained to give the maximum service of which he is capable. The weeding out which is evidenced by the progressive dropping of students in the higher grades is not rational but a necessity under present conditions. Two-thirds of the students in engineering colleges are not suited to that kind of work, and it is just as dangerous for college students to aim above their capabilities as it is for the working men.

High-Tension Transmission.

The first session on Wednesday was called to order by President Mershon at 10:30 a. m. Percy H. Thomas, chairman of the High-Tension Transmission Committee, was called upon to preside. The Committee is engaged in framing specifications for testing high-voltage insulators and has also prepared a series of question sheets which have been sent to all companies operating at a voltage of 25,000 volts or over for the purpose of collecting engineering information on high-tension transmission.

Suggested specifications for testing insulators have been prepared by F. W. Peek, Jr., from the point of view of the expert tester and scientist, and by J. A. Sandford, Jr., from the point of view of the manufacturer. These specificatilons were presented to the meeting by their respective authors. Chairman Thomas then presented a third set of specifications which he had prepared from a study of these two and from suggestions received from others who had considered the subject. For the details of these specifications reference must be made to the original.

The discussion was opened by L. C. Nicholson, who gave the results of a series of tests undertaken to determine the performances of suspension-type insulators when subjected simultaneously to electrical and mechanical stress. It was found that the number of insulators puncturing at a given voltage increased as the mechanical stress was increased. This applied to a number of types. Almost identical results were obtained when the electrical test was applied after removal of the load. About 200 units in all were tested. Mechanical load does not affect the flashover value but only the resistance to puncture. Usually puncture occurred prior to any audible noise such as would indicate cracking. The effect of intermittent loads was not determined. Mr. Nicholson concluded that it was best to test insulators only to the load which it is necessary to sustain in service. The specifications proposed did not cover the process of manufacture. He thought that electrical engineers should study ceramics so that they would be in a position to take this matter up.

H. W. Crozier thought it would be best to omit mechanical tests except for strain insulators, since we must be careful that the tests do not themselves deteriorate the material. He also raised the question whether each unit in a string of insulators should be able to withstand line voltage in a puncture test.

John B. Taylor presented written discussion by H. Koganei, who had carried out a number of tests under oil upon insulators of Japanese manufacture. He found that puncture took place under oil at a voltage about ten per cent less than that necessary in air, and this value was only about 80 to 90 per cent of the flashover voltage.

F. W. Peek, Jr., stated that such results are not found with insulators of American make and he thought they might be accounted for by a concentration of flux at particular points.

C. O. Mailloux thought it best for the electrical engineer not to interfere with the manufacturer. This is liable to increase the cost and decrease the quality. The engineer should specify the results which it is necessary to attain and leave it to the manufacturer to get these results. Hugh T. Wreaks substantiated this point and referred to the specifications for rubber-covered wire as an illustration of it.

Paul M. Lincoln referred to the quality of water to be used in the rain tests and approved the use of condensed steam for this purpose. He also pointed out that it makes a difference whether in the transformer connections the middle point or the end of the winding is grounded. To get the proper static field the pin should be grounded, and this should be specified for tests.

E. E. F. Creighton took up the sub-

ject of how to determine when the porcelain is thoroughly vitrified. In experiments with clay he found both temperature and time were important elements in this. Thus vitrification might not take place at 1,250 degrees and yet be complete at 1,350 degrees. Moreover, it increases with time up to a constant value and the material becomes brittle if the temperature is maintained too long. He thought that the frequencies used in tests should be high, since it is lightning and similar surges which strain the ability of the insulator. Just as in the testing of other materials, insulators should not be strained in testing to the limit nor to the point of deterioration. He mentioned that glass will stand a higher voltage in air than in oil, and explained this as due not to the distribution of flux but to the relief afforded by corona sparks running over the surface.

Ralph D. Mershon also considered it better not to go into the question of ceramics, although it is desirable for engineers to become familiar with the uncertainties of manufacture. He pointed out that insulator material is notoriously nonuniform and yet it is not desirable to test more than a small fraction of the insulators. In rain tests he thought that the factor of safety should be provided by increasing the voltage rather than the precipitation above normal values. He also considered it better to have the spray vertical and turn the insulator at an angle rather than to attempt to apply the spray at 45 degrees. He thought units should be so spaced in the string as to get the full value of each.

E. M. Hewlett pointed out that in a wet test the conditions are often made more severe than those met with in practice. Rain is only experienced at 45 degrees when accompanied by a high wind, in which case the insulator hangs at an angle. He pointed out the personal influence of the worker in pottery and the difficulty of securing uniformity of product. Material can be made to stand an absorption specification of one-tenth per cent, but it is a question whether this quality can be maintained in large orders. With line voltages up to 100,000 volts, he thought the individual units should be able to stand the line voltage, but not on higher-voltage lines. The effect of altitude should be mentioned in the specifications.

P. W. Sothman considered it best to tell the manufacturer what was wanted and leave it to him to obtain results. He did not agree to the use of condensed steam for the wet tests, but thought the water used should simulate service conditions as nearly as possible. While he thought it well for the Institute to draw up a guide for the choice and testing of insulators, he did not favor a rigid specification for this purpose. He pointed out that surroundings of the insulator in service, such as clamps, are often as important as the insulator itself in determining breakdowns.

Others taking part in the discussion were C. F. Scott, J. A. Sandford, Jr., and P. H. Thomas.

Two other papers were presented before the adjournment of this session. They were "Constant-Voltage Transmission," by H. B. Dwight, and "Theory of the Nonelastic and Elastic Catenary as Applied to Transmission Lines," by C. A. Pierce, F. J. Adams and G. I. Gilchrest. The latter was presented by Mr. Gilchrest. The session then adjourned.

Constant-Voltage Transmission.

The discussion of a new and but slightly tested method of operation of transmission lines should first deal with the fundamental questions: Has the method large advantages? Is its cost low? Is it reliable? In the present paper, the aim has been to discuss from the above points of view a method of control transmission lines by means of synchronous motors. The obviously great advantage is offered of steady voltage at all places and under all conditions of load. This is in sharp contrast with nearly all modern transmission systems, where the voltage at some part varies with every change in load. As the carrying capacity of a transmission line can be doubled or trebled by this method of control, the saving in line construction will in many cases more than offset the cost of the additional machinery required. Although loaded synchronous motors are often regarded as an unreliable part of a transmission system, the objection does not apply to unloaded synchronous condensers, and the new method is stated in the paper to be more reliable than the usual method of operating transmission lines. By increasing the economical distance of transmission, this method would hasten the growth of the extensive high-tension networks which are already spreading over large sections of the country. The advantages and disadvantages of the new method are summarized at the end of the paper, and sample lines are worked out, showing cost comparisons.

Theory of the Catenary.

Equations for length of conductor, span, tension and sag are derived on the basis of a flexible elastic conductor. These equations contain functions of ϕ, the angle of bending of the curve in which the conductor hangs, and a constant. The constant is eliminated in two ways leading (a) to the characteristic ratios of the elastic and non-elastic catenaries and (b) to three equations which give the values of tension, length of conductor and sag in terms of each other. Numerical values of the characteristic ratios of the simple catenary are tabulated for angles less than 60 degrees. By means of this table problems based upon the theory of the non-elastic catenary may be solved readily. The characteristic ratios of the elastic catenary are reduced to more simple approximate forms involving the characteristic ratios of the non-elastic catenary. The equations which give the exact values of the ratios of the elastic catenary are too complicated to use. The results of tests on an experimental span approximately 200 feet long are given in two tables and these values are compared with the theoretical values based on the non-elastic catenary.

Industrial Power Session.

The afternoon session was called to order by President Mershon at 2:40 o'clock. John M. Hipple, chairman of the Industrial Power Committee, was called to the chair and presided over this session. The first paper presented was one by F. D. Newbury, entitled "The Behavior of Synchronous Motors During Starting."

Behavior of Synchronous Motors During Starting

The paper presents experimental data mainly in the form of oscillograms which show very completely the effect on field current and armature current of a large number of combinations of starting conditions. From the oscillograms and curves, the following practical operating results are deduced. The effect of the closed circuit on initial starting torque is negligible if low-resistance damper windings of good design are used. With open field circuit during starting dangerous voltages are induced in the field winding. For all ordinary applications, motors should be started with closed field circuit. Successively larger loads can be pulled into synchronism if synchron- moderate loads the minimum starting voltage without excitation; (b) on the starting voltage with excitation; and (c) on line voltage excitation. For moderate loads the minimum starting current is obtained by considerably over-exciting the motor before changing to line voltage. For large loads during starting and synchronizin, minimum starting current is obtained by under-exciting the motor before changing to line voltage. Still further reduction in starting current is obtained by the use of reactance between the change from starting to line voltage, in which case excitation is delayed until the motor is in, or very near, synchronism.

The discussion was opened by W. J. Foster, who spoke of the one bad characteristic of the self-starting synchronous motor—the induced electromotive force at the motor terminals. Short-circuiting the field detracts from the starting torque, although otherwise advisable. It is well to excite the machine by a lower potential during the starting.

A. H. Kruesi asked for full data of the machine for which the curves were given in order to tell how much the results depend upon the design.

R. B. Williamson referred to the meeting at Pittsburgh in April, 1912, and stated that Mr. Newbury's paper cleared up a number of points raised at that time. He considered it best to

start with the rotor short-circuited through a resistance. By taking enough current from the line it is possible to pull heavy loads into synchronism with a synchronous motor. Some of the early machines of this type were made from parts designed for alternators and these were not best for starting purposes. He then discussed the design of such a machine and gave test results, stating that a wound type of rotor is the best.

H. M. Hobart agreed with the latter point and said that the designing had too long been based upon that of the alternating-current generator, but it was now developing into a decent machine. He thought synchronous motors could be used to advantage in smaller sizes—a field now monopolized by the induction motor. The latter has the fault that it must have a high resistance to provide starting torque, while in the synchronous motor such a high resistance is no disadvantage since it is left behind after getting up to speed. It should be realized that the synchronous motor has this advantage in starting over the induction motor.

J. C. Lincoln inquired as to the torque when near synchronism and the type of rotor which would permit reaching synchronism with the least current from the line.

F. D. Newbury replied that the damping winding with the lowest resistance would pull in the greatest load. In the induction motor the reverse is the case. Two starting voltages are not necessary if the proper adjustments are made—a point criticized by Mr. Williamson—but this requires expert attention and he considered it best to have two. The magnetizing current is less in the induction motor and that is why it has been generally preferred.

C. P. Steinmetz stated that synchronous motors, converters and condensers had been used for 20 years and that the number was now rapidly increasing. Most of them are self-starting, although many people are not aware of this and regard the lack of this feature as a disadvantage. They take a large current in starting—about the same as an induction motor—and the latter is never questioned in this respect. The torque is sometimes more and sometimes less than for an induction motor. As to the starting characteristics, it differs from a squirrel-cage motor in the proportion of the parts and is free from the disadvantage under which the induction motor labors at full speed by having to retain its starting resistance. The synchronous motor is hence not so limited in the choice of good starting characteristics. He pointed out three characteristic differences between the two machines: (1) The synchronous motor does not have a uniform reluctance in all positions of the rotor, that is, in all directions of the field, while with the induction motor it is the same. This results in points of low torque or sticking and constitutes a disadvantage of this type. (2) The synchronous motor has a comparatively large air gap, while the air gap must be low in the induction motor. This large air gap is an advantage in starting. (3) High resistance of the rotor is permissible in the synchronous motor. It thus has two advantages to one disadvantage as compared with the induction motor. He then referred to the oscillograms of Mr. Newbury and pointed out much information that could be drawn from them, such as the rise and fall of current with the variation of reluctance as the rotor started to turn. This permits the construction of a torque-speed curve, which it is difficult to get for an induction motor. He pointed out that the characteristics at the point of pulling into synchronism are not generally understood. Pulling in is not so much a question of load as of the momentum of the moving parts. This change of momentum requires more power than the load and consequently there is little difference in the conditions under no load. Comparing the definite-pole rotor with that having uniform reluctance, he did not consider that there was very much advantage either way, the question reducing to one of cost. The points to be considered are the starting torque, locking at full speed and also the locking at half speed, which is sometimes observed.

Others who took part in this discussion were W. J. Foster, W. L. Merrill, H. H. Dewey, and F. C. Caldwell.

H. E. Stokes then presented a paper entitled "Commutating-Pole Saturation in Direct-Current Machines."

Commutating-Pole Saturation in Direct-Current Machines.

The paper discusses the importance of obtaining the characteristic curve of the commutating-pole useful flux, especially in regard to machines designed to withstand heavy overloads. It is pointed out that this curve must not depart from the curve representing the flux required to neutralize the reactance volts of the machine by more than an amount corresponding to a reactance voltage which experience has shown can be successfully taken care of by the resistance of the brush. A method of measuring the useful and total commutating-pole flux is described. The results of tests on two machines are given, together with curves showing the useful and total fluxes obtained. The importance of the ratio of leakage flux to useful flux at low saturations, in regard to maintaining and determining the ultimate point of reversal of the useful flux, is shown. An approximate formula for obtaining the useful flux from this ratio is given. An attempt has been made to analyze the magnetic leakages due to the main and commutating-pole ampere-turns and to show that the paths taken by and the dimensions of these fluxes are to a certain extent dependent on the relative values of the main and commutating-pole ampere-turns. The variation in the relative values of the main and commutating-pole ampere-turns and the absence of uniformity in the magnetic potential of the commutating pole introduces some degree of error into the formula given. To obtain a greater degree of accuracy, corrections have to be made for the varying initial leakage ratio and for the change of magnetic density existing at different points in the length of the commutating pole.

H. M. Hobart stated that the use of the commutating pole should be limited to the purpose for which it was introduced. There has, however, been a rush to take advantage of these poles for other purposes. Such poles should be short in the direction of the shaft, thus reducing the leakage of flux and assisting ventilation. The commutating pole is an antidote, but may prove to be worse than that which it is intended to correct. This subject is finally being reduced to a quantitative basis.

F. D. Newbury stated that designers of direct-current machines are prone to depend upon empirical rules and he was glad to see the author attacking the problem from the physical standpoint.

John M. Hipple mentioned some tests which were recalled by Mr. Hobart's remarks. He stated that it is a question whether the commutating pole would ever have a place in the design of a constant-speed motor. He recognized the point of view, however, that such a pole may be regarded as a prime factor in design.

In closing, Mr. Stokes stated that commutating poles usually have a length equal to about 60 or 70 per cent of the length of the armature. Leakage is reduced by keeping the length down and flattening the commutating poles near the frame.

A paper by J. C. Parker, entitled "The Industrial Use of Synchronous Motors by Central Stations" was, in the absence of the author, presented by H. W. Peck. Owing to the limited time at the morning session, the paper by Mr. Dwight, entitled "Constant-Voltage Transmission," which also dealt with the subject of synchronous motors, was discussed in connection with this paper.

The Industrial Use of Synchronous Motors.

Synchronous motors in industrial use find their application in large group drives not subject to frequent starting, nor to starting under full load. A commercial motive must be supplied to the user through power rates favorable to unity-power-factor or leading load. Under such circumstances the use of constant-voltage relays for potential regulation in conjunction with series reactance is recommended in cases where leading power-factor on

the feeders can be secured. Segmentation of the feeder by means of series reactance with a synchronous motor on each segment is recommended as giving uniform voltage distributed over the length of the line. The adaptation of the driven apparatus to synchronous-motor starting conditions and to variable output at constant driving speed is suggested.

F. D. Newbury cited a case where a synchronous condenser was an absolute necessity to hold the voltage down at low load. In reply to a question as to the comparative effectiveness of synchronous machines when running loaded and when running light, he pointed out that the total current taken by the machine was definite and that the greater the power component of this current the less must be the wattless component. The vector sum of the two must remain constant.

Lee Hagood regarded the results shown by Mr. Dwight as surprising for such a simple method. He referred to a recent case in which he was interested where design of the line was started by picking the size of the synchronous condenser and he showed curves illustrating this.

N. E. Funk stated that the conditions would be better in almost any case than without a synchronous condenser. He considered it preferable to have inductance and capacity balanced at the generator end of the line rather than at the load end; that is, to have 100-percent power factor at the generator, rather than a leading current. Since generators cost about twice as much as the same capacity in synchronous machinery, it is advantageous to correct by the latter means.

H. W. Peck pointed out that obsolete generating equipment, such as motor-generator sets, could probably be used to advantage as a synchronous condenser on a long feeder.

Burton McCollum pointed out that in Mr. Dwight's paper the loss of efficiency might in a certain case overbalance the saving in first cost. In such a case the advantage is in the operating conditions rather than in any economy.

Mr. Dwight in reply analyzed the case in question and showed that there would be a financial advantage. He also gave figures to show the advantage of an adjustable power-factor over a high power-factor. The important quantity is the wattless kilovolt-amperes rather than the power-factor. He stated that Mr. Parker's paper applied to low-voltage lines and his to high voltage. In the former case there might be a question of balancing a synchronous condenser against a high-voltage transformer and a high line voltage. He considered it difficult to meter the kilovolt-amperes which it is proposed charging for in cases where the central station depends upon consumers to install synchronous machines. A synchronous condenser accomplishes more than a synchronous motor; the latter merely supplies a high power-factor, whereas the condenser enables the operator to correct line conditions produced by other consumers.

M. O. Dellplain agreed with Mr. Parker that synchronous motors present a theoretical advantage to the central station, but this is practically offset by other features. While from the point of view of distribution and increase in central-station capacity there is an advantage, on the other hand there is the disadvantage that the synchronous motor is not as simple as the induction motor and may prove dangerous if the customer is not adept in its use. In order to charge the customer on a basis of kilovolt-amperes we need a reliable polyphase meter indicating this quantity. If the system should be unbalanced and readings are being taken from single-phase instruments, using the highest reading of an instument in any phase, this would offset the advantages.

H. W. Peck stated, in closing the discussion, that service conditions are often more important than getting a high power-factor. The synchronous condenser cannot be well replaced by a transformer and high line voltage because the operating man wants a single distribution voltage in use for the entire system. It is not feasible to put synchronous machines in for every customer, but there are many places where the men are sufficiently trained to handle them and they would operate satisfactorily. The only question is whether the conditions warrant the company in paying part of the cost.

The final paper of the session was then presented by C. A. Kelsey. It was entitled "Electrical Requirements of Certain Machines in the Rubber Industry."

Electrical Requirements in the Rubber Trade.

The paper outlines the principal operations carried on in a rubber factory and gives some figures on the corresponding power requirements. The crude rubber as it comes from the forest or plantation must be cleaned, thoroughly kneaded, and mixed with various ingredients to form the final compound. Rubber has a great capacity for absorption of power and is materially benefited thereby. Electrical power can be advantageously used in the working-up of rubber, particularly in rolling the compound into sheets, where adjustable-speed operation is productive of economies. The author concludes with a comparison of methods for obtaining adjustable-speed operation and points out the desirable features which should be embodied in the control.

Thursday Session.

The session on Thursday morning was called to order by President Mershon promptly at 10 o'clock. The first part of the session was under the auspices of the Power Station Committee, which had to offer a paper by H. G. Stott and W. S. Gorsuch, entitled "Standardizaton of Method for Determining and Comparing Power Costs in Steam Plants." This was presented by Mr. Stott.

Power Costs in Steam Plants.

This paper makes a detailed proposal for a method of accounting to determine cost of power in steam plants. It considers (1) production and production repairs costs, (2) investment costs, (3) general and miscellaneous administration expenses, (4) total cost of power, and then goes into an analysis of the elements in section (1). The basis of comparison should be the kilowatt-hour of net output. A skeleton is given for analyzing the different elements of cost. A table of values of life-expectancy and scrap value is given in connection with amortization. General expenses are apportioned in proportion to other costs exclusive of investment costs. Curves are given showing the valuation of the elements of cost with load-factor and it is deduced that cost of production plus production repairs, using coal, values approximately as the inverse fourth root of the load-factor. This holds between 15 and 90 per cent, and is applicable to a single plant. In comparing independent plants, results should first be reduced to a common load-factor. A figure of merit is deduced for comparing coal of different characteristics besides heating value, and a similar reduction factor for comparing relative labor costs.

Mr. Stott, who is chairman of the Power Station Committee, then took the chair and called upon Henry Floy to open the discussion. Mr. Floy expressed his appreciation of the great value and interest of the paper. He pointed out some of the details wherein it was not complete. Among these was the cost of water. He could not agree that the prorating of the expenses of administration was fair, but particularly took exception to the figures of life-expectancy and scrap values, since these do not agree with other well established figures. The use of five per cent in the illustration of interest charges he considered inadvisable, since this figure is lower than capital can be obtained for. He illustrated this statement by the fact that the state of Tennessee paid six per cent for its state loan and mentioned utilities which under commission regulation earn much more than this.

Carl Schwartz considered the exchange of cost data between power plants very beneficial. He thought this comparison should be as simple and short as possible and that accuracy might well be sacrificed for this end. It might also be well to express the different elements of cost in per cent

of the total. He discussed the distinction between physical and functional depreciation and pointed out the irregularities which might enter in the accounting of such items as insurance. For depreciation he thought it better to use a fair average value for the entire plant rather than separate values for the various items. He made a critical analysis of many points entering into the comparison of costs, and stated that with minor revisions the paper should give an excellent basis for such a comparison.

William McClellan also considered that the outline gave an excellent basis for committee work on this problem. He made a motion, which was afterwards passed, referring the matter to the Board of Directors for reference to the proper committees for immediate action. He stated that utility companies are finding out there is no objection to making their cost figures public and that even though certain ones may consider this objectionable, they will soon find it necessary to do so from legal compulsion under regulating commissions. Knowledge of the items involved is very necessary to the managers themselves and comparison between different plants is also very valuable, but he thought it would be necessary to classify companies according to size and other characteristics for this purpose.

P. Junkersfeld referred to the work which has already been done by the National Electric Light Association and the American Electric Railway Association in the standard classification of expenses and accounting. The two have almost identical schedules for power-house costs. Costs should always be based upon net and not gross output. Investment costs are the most difficult to handle and he thought it best to first consider operating costs. General expenses do not have a constant proportion and are very difficult to handle. He considered spare capacity an important item and pointed out that this varied a great deal in different plants, 10 per cent being sufficient in some instances, whereas 20 per cent was necessary in others. He considered a very low maintenance account a suspicious circumstance which invited further investigation.

D. B. Rushmore made a comparison between manufacturing costs and power costs. He thought it would be well if affiliation could be arranged with the engineers of public service commissions in achieving the results desired.

A. H. Kreusi thought the outline could be made to include stations supplying steam for heating or manufacturing as well as power. Not only load-factor but station-capacity-factor should receive consideration.

W. I. Slichter pointed out that the subject under consideration should be denominated "cost of energy" rather than "cost of power." C. O. Mailloux agreed with him and pointed out that in Europe energy is always the word used in this connection.

D. C. Jackson referred to the load-factor law which had been enunciated by the authors and stated that he had found it to apply to operating costs in one station at different times, but did not think it would apply between two different plants. He also pointed out that the cost of distributing energy is often greater than the cost of generation and is just as important to the operating company. He pointed out the distinction between insurance and depreciation, the nature of the two being totally different.

H. M. Hobart pointed out the effect of power-factor upon the cost of energy. This is often considered as affecting the cost of the transmission line merely, but it has a marked effect upon energy costs. It should also be realized that it costs more to generate energy in the form of single-phase than three-phase, and this also should be considered. Since the capacity of machinery is lower in the summer than in the winter, stations should be considered with respect to their annual capacity in kilowatt-hours.

C. D. Gray thought that the cost of energy from hydroelectric stations should be included in the consideration and this would require only a slight change in the outline proposed.

R. D. Mershon, P. W. Sothman and P. M. Lincoln also participated in the discussion.

W. S. Gorsuch, in closing the discussion, pointed out why administration costs should be included in the cost of power and referred to the difference in exchanging power between two stations and in shutting down one and purchasing power from the other. He also pointed out the objection to considering depreciation of all elements in a lump rather than individually. He considered the average daily wage the only proper basis to make a comparison for labor costs and to determine the correction factor under different conditions.

Electric Lighting Session.

The remainder of the session was under the auspices of the Electric Lighting Committee and in the absence of the chairman of that committee, P. Junkersfeld was called to the chair. The first paper presented was by H. R. Summerhayes, entitled "Automatic Substations." This was followed by 'Converting Substations in Basements and Subbasements," by B. G. Jamieson, which, in the absence of the author, was abstracted by D. W. Roper. The last paper to be presented was by N. E. Funk, entitled "Operation of Frequency Changers." These three papers were discussed together.

Automatic Substations.

In this paper the description of an automatic synchronous-converter substation is prefaced by the mention of a number of more familiar instances of automatic operation, in which electric motors or generators operate without regular attendance. The paper then describes the Detroit automatic substation in which a 60-cycle, 500-kilowatt synchronous converter supplying current to a 125/250-volt, three-wire direct-current lighting system is operated entirely from a distant station. An interesting feature of this installation is the absence of control wires, as the three-conductor, 4,400-volt cable carrying the alternating-current supply current to the station is used in connection with the automatic devices in the station to start, load and stop the machine, and the automatic devices furnish protection.

Substations in Basements.

This paper treats of methods of overcoming the difficulties attendant upon the installation of synchronous-converter and battery substations in basements in the downtown district of a large city. The combined capacity of such substations is 42,000 kilowatts, serving 0.81 square mile in which are many high commercial buildings with a connected load of 97,000 kilowatts. This type of substation is divided into two classes: (1) the basement type, and (2) the subbasement type. Description and illustration of a typical machinery intake for a class (2) substation are given, also methods and difficulties or bringing in apparatus. The air supply for the apparatus is next considered. A special air-cleaning device is described. Description and illustration of a supply and exhaust system for ventilating the apparatus are given. The difficulty in providing air cooling equipment for larger units has been responsible for the adoption of the oil and water cooling system, particularly for transformers and regulators. The nature of the foundation structure of large buildings limits the adoption of the floor construction for the electrical apparatus, which is the reason for the comparatively high structural cost. The floor space required for small units (500 kilowatts) is 0.95 square feet per kilowatt, and for large units is 0.54 square feet per kilowatt. The plan and elevation of one of the largest and most modern substations of the subbasement type are shown. The ultimate capacity of this substation is 16,000 kilowatts with a 1,875-kilowatt battery. The floor space is 10,600 square feet.

Operation of Frequency Changers.

This paper analyzed the fundamental theory underlying the parallel operation of frequency changers, and considers the various running conditions imposed upon them. The theory is then applied to the operating conditions in such a manner that it is possible for the operator without technical information, to automatically obtain the correct conditions applying to synchronizing under all possible conditions of load. Starting by means of a separate motor and by the use of

one of the machines of the frequency set are considered. The effect of different percentages of armature inductance on parallel operation is studied.

The discussion was opened by D. B. Rushmore, who pointed out the possibilities which are opened up by the automatic substation. He referred to a substation involving revolving machinery which was mounted upon a pole and was running continuously without attendance.

F. D. Newbury did not think polarity could be so well taken care of in a station where there was no storage battery. He referred to the necessity of clean air in basement substations and referred to the possibilities of washing the air as well as cleaning it.

F. C. Caldwell mentioned an automatic resetting circuit-breaker which has recently been developed and is about to be put upon the market, whose switch will close down as soon as the direct current is reduced below the overload value.

H. M. Hobart, speaking in regard to the washing of air, referred to the Deptford station of the London, Brighton & Southwest Railway in England, where the ventilating air for the turbogenerators is washed by falling water. This method has an advantage over screens since the latter may become clogged, with the result that the machine gets hotter.

H. W. Peck, speaking from the standpoint of the operating man, stated that he would have no hesitation in using the automatic substation, since it is necessary to depend upon automatic equipment even when attendants are present. He should like to see the same method worked out for the use of synchronous condensers. This would do away with one objection of the latter, which is that they require skilled operators. Such stations also meet the objection frequently raised and sometimes even by regulatory commissions, that one man must not be left alone in a station.

Paul M. Lincoln asked a question of one of the authors and Mr. Summerhayes then replied. He stated that large machines could be operated automatically just as well as small ones and the only reason for hesitation in this matter was on account of the large investment involved, which might afford a reason for employing an operator. The method, however, is just as reliable for large machines as for small ones. He stated that John B. Taylor had devised a polarized relay which would insure the proper polarity of excitation with synchronous apparatus. This relay has a dashpot which prevents quick action and hence cannot be operated by alternating current. When synchronism is attained it is operated by the direct current, providing the machine has built up with the proper polarity; otherwise the relay does not operate. Synchronous condensers can be operated by the same method without attention and it is possible to restart a machine in case the line voltage has gone off for a short time. The Detroit substation described in the paper is in an unheated building. Its operation appears to be satisfactory, as no trouble is heard of from it. It is inspected daily.

D. W. Roper stated that the only objection to washing in place of screening for substations was due to the limitation of space, since washing apparatus requires more space than the cleaning devices used.

N. E. Funk, in closing the discussion, answered a question in regard to forcing oil under the bearings in starting by stating that this had been found necessary in large machines but not in the smaller units. The session then adjourned.

Presentation of Edison Medal.

A session was held on Thursday evening at nine o'clock at which the Edison medal was presented to William Stanley. President Mershon presided at the meeting and introduced C. O. Mailloux, who in the absence of Elihu Thomson, chairman of the committee of award, made the presentation address.

Mr. Mailloux referred to his personal acquaintance with the recipient, which began about 30 years ago, just before the organization of the American Institute of Electrical Engineers. Mr. Stanley was at that time in charge of an exhibit of the Brush system of series arc lighting in New York City. The early work of Mr. Stanley was related in some detail, reference being made to his idea of the parallel operation of transformers, his invention of the autotransformer, the dynamo which he exhibited at the Electrical Exposition in Philadelphia in 1884, etc. It was pointed out that the transformer made by Mr. Stanley in 1884 is substantially the same as that in use at the present time, later modifications being only in refinements of design made possible through improvements in the material used, such as magnetic qualities of the iron, insulation, etc. Mr. Stanley's alternator with radial cores, designated as the first practical machine of its kind, was also referred to. These constitute his epoch-making work, which had practically created a new art by 1888. The other work of Mr. Stanley was referred to rather briefly, including his constant-current dynamo, his system of induction motors, his work upon the single-phase commutator motor, his magnetic-flotation wattmeter, and his present work in heating devices, which the speaker hinted might prove equally important and epoch-making as his earlier work.

The medal was then presented to Mr. Stanley by President Mershon.

In responding, Mr. Stanley spoke of the debt which the present generation owes to past scientists and inventors, and pointed out how much we owe to science itself. The need of today is for inventors in other lines, who can cope with the present wants in economic adjustments and social conditions. He referred to the epoch-making discoveries of the last ten years regarding the constitution of matter, and thought that these might perhaps prove the most important discoveries in scientific history, which will later be made use of by inventors for the benefit of mankind. He regarded all phenomena, not only physical but intellectual as well, as being controlled by definite laws, and he thought the time would come when these laws would be fully understood by man and would lead to more definite, equitable and permanent social and economic adjustments. Every application of knowledge advances civilization and promotes the welfare of mankind.

Meeting of Section Delegates.

Following the presentation of the medal to Mr. Stanley there was a meeting of section delegates at 10 p. m., presided over by P. M. Lincoln, chairman of the Sections Committee. This was in the nature of an experience meeting and each delegate was called upon to tell how the work of his own section was carried on.

The section delegates lunched together each day during the convention and the lunches were followed by meetings for discussion, which sometimes lasted the entire afternoon. It was indeed a busy convention for the delegates. The result of these long deliberations was the passage of a number of resolutions calling the attention of the Board of Directors to what the delegates considered to be the present needs for changes in Institute work and administration.

Among these were provisions for territorial vice-presidents, whose offices should be of an honorary nature and not involve any definite duties; greater publicity for the meetings of the delegates which should be published in the *Proceedings* of the Institute; the extension of the territorial limits of the sections where this is desirable; the holding of future conventions either at large centers of population or in cities where there is considerable engineering activity.

Corona and Electric Strength of Air.

The last session of the convention was held on Friday morning and was called to order by President Mershon,

who turned the chair over to John B. Whitehead, chairman of the Electrophysics Committee. The first paper presented was one by John B. Whitehead and T. T. Fitch entitled "The Electric Strength of Air—IV." This was presented by Professor Whitehead.

The Electric Strength of Air.

The investigation of the influence of pressure on corona formation described in a former paper is extended with larger apparatus so as to include a wider range of pressure and diameter of conductor. The results show that the influence of pressure in this extended range are in substantial agreement with the relation expressed in the formula suggested by Peek. A few observations were also made on the influence of temperature within the range 5 to 55 degrees centigrade, and these observations are also in accord with the empirical relation mentioned. Observations with carbon dioxide as a gas indicate that the critical corona intensity is independent of the absolute density of the gas, but depends on the number and spacing of the molecules in accord with the theory of secondary ionization. A short discussion of the results in the light of the theory of ionization by collision is given.

The next paper, by W. W. Strong, entitled "The Positive and the Negative Corona and Electrical Precipitation" was, in the absence of the author, presented by Paul M. Lincoln.

Corona and Electrical Precipitation.

High-voltage alternating current was rectified by using the Lemp synchronously rotated commutator and the coronas produced by the rectified current were used to cause the removal of suspended matter from gases. The difference between the wattage-volt curves for the positive and negative coronas are discussed. The sparking potential difference between a negative and a positive corona discharging wire and a surrounding earthed cylinder is described and an application is made to the problem of electrical precipitation. The negative corona is found to be much more suitable for this purpose. For the same voltage loss due to positive corona is slightly greater. Increasing the air velocity within small limits does not greatly affect the sparking potential of a positive corona. It increases the sparking potential of the negative corona very appreciably The corona watt loss is considerably greater in hot ionized gas than in air. The positive corona tends to go over to an oscillatory spark while the negative corona is more easily changed into an arc form of discharge. The presence of suspended matter in the gases does not affect the corona currents greatly. The presence of suspended matter in hot gases increases the sparking potential in these gases. This is a problem due in part to the disappearance of the smaller ions. The presence of suspended matter in ordinary air decreases the sparking potential.

F. W. Peek, Jr., then presented the third of his series of papers entitled "Law of Corona and the Dielectric Strength of Air," dealing with the theory of rupture.

A Theory of Rupture.

Air at the surface of small wires has an apparently greater strength than air at the surface of larger ones. It has been found that the breakdown gradient may be expressed $g_v = g_o(1 + k/\sqrt{r})$. This means that at breakdown the gradient is always equal to g_o, at $k\sqrt{r}$ centimeters from the conductor surface, independent of the size of the conductor. The explanation seems to be that energy is necessary to start rupture and that, therefore, rupture can not start at the surface, but only after the surface gradient has been increased to g_v, in order to store the rupturing energy between the conductor surface and the surface where the gradient is g_o. If the energy theory is true the energy-storage distance should vary with δ. This has been found to be the case, that is, energy-storage distance $= k\sqrt{r}/\sqrt{\delta}$. Therefore $g_v = g_o\delta(1 + k/\sqrt{\delta r})$. The effect has been found to be the same whether δ is varied by change of pressure or temperature. According to the above theory if the wires were spaced very close together, so as to interfere with the free energy-storage distance, it would be expected that g_v would increase in value in order to store sufficient energy to start rupture in the limited distance. It has been found that the gradient begins to increase at a spacing of $2\ k\sqrt{r}$ centimeters, and values as high as 200 kilovolts per centimeter have been reached. Spheres were used in these tests, as it is impractical to adjust cylinders at small spacings.

The last paper to be presented was one by Edward Bennett entitled "An Oscillograph Study of Corona." All four of these papers were discussed together.

Oscillographic Study of Corona.

A method of obtaining oscillograms of the charging current of a ten-foot length wire is described. The method is to multiply this charging current—which is of the order of 0.005 amperes—by 100, by passing the current through the primary of a 1-to-100-milliampere current transformer, the secondary of which is closed through an oscillograph vibrator. The paper contains a series of oscillograms obtained by this method, showing the wave form of the charging current of wire surrounded by corona. These oscillograms were taken at air pressures from atmospheric to 0.13 centimeter of mercury. They show the marked asymmetry in the current after corona forms, the relation between power loss and impressed voltage, the start of corona after switching, the marked difference in the results at high and low pressures, etc. The distortion in the current wave form, which results from copious ionization at the time of the voltage peak, is observed simultaneously with the hissing sound and bluish discharge from the wire. The boundary of the ionized region does not gradually expand outward from the wire with the increase in voltage during the half cycle. The loss of insulating properties in the air must be conceived of as taking place with extreme suddenness. At air pressure near atmospheric the loss of insulating properties by the air is much more sudden in the half cycle in which the wire is cathode, and at voltages slightly higher than the corona voltage, the power loss in the corona is greater during the half cycle in which the wire is anode. At higher voltages this percentage difference becomes extremely small. At low air pressures, for a considerable range of voltages above the corona voltage, copious ionization seems to occur only during the half cycle for which the wire is the cathode; at these voltages the peak value of the current when the negative ions travel outward from the wire is far higher than when they travel inward toward the wire; the time of outward flow is, however, far shorter than the period of inward flow. Under these conditions, it is seen that the average values of the currents in the two directions may differ but slightly, while the root-mean-square values are greatly different. At voltages above the corona, copious ionization sets in at a lower voltage in the half cycle for which the wire is the cathode than in the other half cycle. The quadratic relation between power expenditure in the corona and the impressed voltage, developed by other investigators for parallel conductors, is shown to apply to the single case of concentric cylinders for which the losses were obtained.

The discussion was opened by Charles F. Scott, who spoke of the history of the Institute literature upon this subject, calling attention to the work of Mershon, Ryan and others.

Lewis T. Robinson spoke of the possibility of measuring high voltage by means of corona phenomena. He pointed out that the current transformer had been used with the oscillograph by others and that while the current required to actuate the oscillograph is large the necessary power is small, amounting to perhaps 0.02 watt. Of course this is large compared with a moving-coil galvanometer, which may require only 0.0001 watt for a full-scale deflection.

Alan E. Flowers spoke of previous work which had been done in the line of precipitation by electrical discharge. In cement mills a change of velocity has been found more effective for this purpose than electric precipitation, the efficiencies of the two methods being about as 98 and 92 per cent. He referred to the work of Milner in England in plotting volt-ampere curves for a small sphere gap at a high frequency of oscillation. This work indicated that a high voltage was needed only once to start the discharge, after which it could be re-established by about 300 volts each time. The results obtained were the same at all frequencies, which went up as high as 200,000,000 cycles per second. This indicates that ionization disappears with tremendous rapidity. He suggested the use of the string galvanometer for obtaining oscillograms of very small current. He also referred to the work of Watson, who had used 100,000 volts from an influence machine and thus obtained corona

with direct current. The observations were not, however, very accurate, but showed that there was a power loss with direct current.

P. M. Lincoln pointed out that the formula usually given connecting power loss with frequency could not hold except through a small range, since it would give zero loss for direct current.

Others taking part in this discussion were John B. Taylor, V. Karapetoff, W. H. Pratt and W. J. Hammer.

John B. Whitehead pointed out that even a small air velocity makes a big change in ionization values, and he thought that Dr. Strong's results had been affected by this fact. He did not think that the assumption of an energy zone in the theory of Mr. Peek was necessary. The ionization theory serves to explain the phenomena and an immense amount of work has been done based upon it. The number of free ions normally in the air is about 1,000 per cubic centimeter. He stated that he was perfecting an apparatus based upon a wire and surrounding cylinder for measuring voltage. The accuracy of repetition with this apparatus is greater than the constancy of voltage on commercial circuits. It is much more refined than the spark gap with either needles or spheres. It must be easy, however, to change the size of wire, which must be frequently replaced and kept clean. With proper corrections for temperature and pressure he thought it would be easy to measure voltage to a fraction of one per cent. One difficulty in perfecting this instrument commercially is that the gold-leaf electroscope is not easily portable. Visual observation of corona is not satisfactory for this purpose, but by using ear pieces for hearing the corona start, it is easy to fix the instant when it begins.

F. W. Peek, Jr., stated that the loss found by Watson with direct current was about one-fourth that found by him at 60 cycles. The losses increase with air velocity. Within the commercial range the loss has been found proportional to frequency but this relation evidently cannot hold at the extremes of frequency. He defended the theory of the energy zone by pointing out that it had been fruitful and had led to the form of equation given in his paper, which was found to agree with experimental facts.

Edward Bennett, in closing the discussion, stated that the string galvanometer could not be used for these frequencies. He referred to an instrument invented by Professor Ryan for measuring voltage by means of corona. This consisted of a conical conductor inside of a cylinder and the point on the cone at which corona took place was a measure of the voltage. He did not favor the theory of the energy-storage zone, which he did not feel could be justified or supported. An analytic expression can always be found for any observed facts.

Entertainment.

Elaborate entertainment features were arranged by the committee in charge, of which W. C. Smith was chairman. On Monday evening there was a reception and dance in the ball room of the hotel, those in the receiving line being President Mershon, President-elect Mailloux, Ex-president Jackson and Secretary Hutchinson.

On Wednesday evening H. W. Crozier, delegate from the San Francisco Section, gave a lecture on the Panama-Pacific Exposition to be held in San Francisco in 1915. Following it there was an electrical show prepared by H. A. Horner, which contained a number of very clever hits on the electrical fraternity. On Thursday afternoon Vladimir Karapetoff gave a lecture-recital on Chopin.

The Games Committee, under the chairmanship of Farley Osgood, prepared contests of various kinds, with suitable prizes for the winners. Among the prizes offered was the Mershon Golf Trophy, which was contributed by the president and is to be finally awarded to the man twice winning the golf championship at the summer conventions. The tournament this year was won by A. M. Schoen, with Comfort A. Adams second.

The tennis tournament was won by G. A. Sawin, the runner-up being C. T. Mosman. The fishing prize for the largest catch went to E. B. Merriam, while the prize for the largest single fish was carried off by E. B. Craft.

The baseball game was won by the "Has Been" team, under the captaincy of W. A. Hall, by a score of 13 to 8. The prize for the longest hit went to C. T. Mosman, that for the most strike-outs to G. A. Sawin, while F. D. Newbury, M. G. Lloyd and W. L. Upson were tied for the greatest number of runs scored.

The first prize in the ladies' court golf was won by Mrs. Garland, the second prize going to Mrs. Craft. The shuffleboard honors were carried off by Miss Maver. A card party for the ladies was given on Wednesday evening, first and second prizes at bridge-whist being won by Mrs. Cheney and Mrs. Sawin. The prizes at hearts were won by Mrs. Foster and Mrs. Coughlin.

On Tuesday afternoon a steamer excursion on Otsego Lake was participated in by all. On Wednesday morning an automobile trip around the lake was arranged for the ladies.

CANADIAN ELECTRICAL ASSOCIATION.

Annual Convention Held at Toronto, June 25-27.

The twenty-third annual convention of the Canadian Electrical Association was held in Toronto, Ont., on June 25, 26 and 27, at the Chemistry and Mining Building of the University of Toronto. The total registration was 284, of whom 58 were ladies.

It was definitely decided that the basis of the Association was a business co-operation between privately owned central stations, solely, and that municipal central stations should not be admitted to membership.

The convention was opened by President W. L. Bird, the general manager of the Kaministiquia Power Company, Fort William. His address was of a general character, calling attention to the rapid development in the electrical field, especially in the case of transmission and distribution systems. As he aptly put it, "the transmission lines and voltages of yesterday are the distribution lines and voltages of today." Another point upon which great stress was laid, was that rates are secondary to service. In the overhead charges and expenses of any manufacturing plant, the cost of power is only a small percentage of the total charge. An interruption, however, in the power supply becomes quite an item, on account of the labor, material and time lost. Central stations, therefore, should pay more attention to the continuity of service than to the question of rates.

The secretary's report showed the following membership:

Class A, 50; Class B, 450; Class C, 35; Class D, 11; Class E, 73.

The treasurer's report showed a balance on hand of $1,157.96 with unpaid dues amounting to $2,460, of which $1,830 is the share of the National Electric Light Association.

The honorary secretary, T. S. Young, presented a report on the results of 1,000 letters that were sent out to various companies and individuals interested in the question of reorganizing the Canadian Electrical Association, making it broader in its scope and including municipal central stations in its membership. The replies received showed 173 in favor of reorganization and 36 against it. He also read a number of suggestions received from various members.

The meeting was then thrown open for general discussion of the subject. Although a general invitation had been sent out to all interested to express their views on this subject there were few representatives of outside inter-

ests. Various suggestions were made by A. B. Lamb, E. J. Phillips, J. S. Gould and A. A. Dion. The latter thought that control of the Association should be in the hands of private companies and would prefer to give up the name rather than connection with the National Electric Light Association.

The matter was finally referred to the executive session for action. At that time it was resolved to let the constitution of the Association remain unchanged.

T. C. Martin, secretary of the National Electric Light Association was present and voiced his appreciation of the action taken.

E. W. Lloyd, of Chicago, also spoke in behalf of the National Association and asked for more general participation by the members of the Canadian Association in the work of the various committees. He advocated a uniform basis for rates among the Canadian central stations.

The two papers presented at the opening session were "Graphic Meters" by G. W. Gratton, and "Integrating Wattmeters with Recording Attachments" by H. S. Baker. These two papers were discussed together.

Graphic Meters.

This paper discusses the general principles of graphic meters, their performance care and cost of operation. Graphic meters may be said to be of two types, the relay type and the direct-acting type. In the relay type the measuring element does not do the work of operating the pen, but closes a set of auxiliary contacts which close the circuit through the relay coils, or solenoids, that operate the pen. This keeps the pen friction, etc., away from the measuring element, and tends toward greater and longer accuracy, due to lighter moving elements· also the instruments do not require so much power to operate, that is, the shunt losses will be much less, as the instrument does not require as great a torque to operate the pen. It also means considerable saving in transformer capacity to operate the instrument.

In the direct-acting type the measuring element operates the pen directly on the chart, so that the moving coils are obliged to have a large torque in order to overcome the pen friction, etc.

The selection of a graphic depends on several conditions, such as the nature of the load, the terms of the contract, and the accuracy by which the load must be measured. If the charges are based on the indications or readings of the graphic, then one should be chosen that has good accuracy and that will remain accurate, even if it is the most expensive. On the other hand, if the graphic is merely intended to show the nature of the load, or to indicate when a peak or contracted load has been exceeded, an instrument that is not so accurate, and probably cheaper, may be used.

The speed at which the paper shall travel is determined by the character of the load to be measured and the duration of the peak.

In choosing the scale capacity of a graphic meter it should be so chosen that with the average working position of the pointer or pen it will be at least half way across the chart. This tends to better accuracy in reading, and in case of an alternating-current wattmeter this would allow it to operate on a load with a low power-factor without overloading the current windings and still keep the pointer well up on the scale.

Regarding repairs and maintenance, the paper states that one man should be detailed to look after repairs and troubles. He should be experienced and only attempt minor repairs on the job. Data are given on the cost of repairs.

Integrating Wattmeters with Recording Attachments.

In general, electric meters for registering peak loads may be classed under three headings; (1) indicating meters operating pens, known as graphic recording meters, which give a continuous record on a paper chart of the momentary values of power every instant of time; (2) integrating demand meters which sum up the kilowatt-hours for given intervals and register the kilowatt-hours consumed in each interval; and (3) heavily damped indicating meters made for registering peak loads whose indications approach the true present value of the power at a rate which is proportional to the difference between present indication and the present true value of the power, the maximum swing of the meter being taken as the peak load. The watt-hour type of meter possesses a distinct advantage over the indicating type in that it takes accurate account of sudden swings of load, which the indicating type does not. Both the watt-hour type and the graphic indicating type posses the advantage over the third type of instrument in that the relation between actual power and theoretical registration is much more easily covered in the wording of power contracts A form of integrating demand meter developed by S. Piek and R. C. Downing is described, which graphically registers indications of power during one minute or greater intervals. This instrument consists of a Westinghouse watt-hour measuring element with certain recording devices designed by these two electricians. The advantages claimed for this meter over ordinary types of the graphic meter include a reduction in interruptions of the meter chart due to clock and pen trouble, the increased permanency of calibration, increased accuracy in the reading of peaks, reduce maintenance expense, and ease of determination of peak loads on a kilowatt-hour basis.

The discussion was opened by Mr. Brown, of the Canadian General Electric Company, who criticised the "relay" type of meter on account of its sluggishness. Transformer costs can usually be divided up among a number of instruments operated from one set of transformers.

C. G. Keyes and A. L. Mudge also joined in the discussion.

At the afternoon session the first paper presented was "Organization of Appliance Department," by B. E. Rowley.

Organization of Appliance Department.

The appliance salesman should be a part of the central-station service. He should be instructed to make careful note of all complaints, and see that the proper department follows and adjusts them. If men of the right caliber are employed for a house to house canvass, and they are properly instructed, the day will certainly come when at a critical point their efforts will turn the scale in favor of their employer. Public demonstrations are profitable, as they educate the ladies in the use of appliances and are thus the means of making many sales. A large attendance can be obtained by sending out numbered announcements and offering one appliance free to the lady who happens to have the prize winning number. The announcements should have printed upon them a list of the appliances to be demonstrated, and the invited guest should be instructed to mark with a cross the one she prefers. These cards are signed and collected during the demonstration, and at its conclusion the prize is awarded to the one holding the fortunate number. It is a good plan to ask dealers in lighting fixtures and lamps to take part when a public demonstration of electric heating appliances is to be made. A short address on correct and economical lighting plans for residences, and a description of the history and theory of electricity as applied to cooking and heating will help make the evening a profitable one. Music and a few flowers are also in order. Salesmen may be drawn from a number of different sources. College men usually have the personal appearance and mental training that especially qualifies them in selling appliances to the housewife. Many young college men have taken up this line of work during vacations and have been so impressed with its possibilities, that upon leaving school, they have again entered the field. In the employment of salesmen, it has been found advisable by some companies to place them under a small bond. The reason for this is that the men collect considerable sums of money. The bond is paid for by the company. Numerous plans for paying salesmen have been tried out. Some men prefer being paid a liberal salary and a small commission on sales. There are a number of advantages in this system. The sales force should hold frequent meetings for the exchange of ideas and experiences. It may be well to invite traveling men or local salesmen in other lines to address this meeting once in a while. As a preliminary step to a house to house canvass, it is well to mail advertising matter to prospective consumers a few days before the salesman calls. Systematic methods of keeping records of sales and selling campaign costs should be kept in the company's office. The central-station company should strive continuously to maintain the good will and stimulate the co-operation of the local dealer in electrical supplies. Ill feeling on his part may prove a very serious handicap to making sales.

In opening the discussion Mr. Pratt stated that contractors should be educated to supply more outlets for appliances when wiring a house, such as

floor, wall and baseboard receptacles.

A. A. Dion suggested co-operation between solicitors, demonstrators, window trimmers and advertising departments to obtain the best results.

H. F. Strickland then presented "The Hydro-Electric Rules and Regulations and the National Electrical Code."

The Hydro-Electric Rules and Regulations and the National Electrical Code.

The National Electrical Code has been adopted by every municipality in Canada and most of those in the United States as the basis of regulations governing electrical construction. However, the Hydro-Electric Power Commission, of Ontario, deemed it advisable to investigate the merits of every available practice both in America and in Europe in order to satisfy itself as to the best rules and regulations obtainable. In writing rules it is a very difficult task to make them sufficiently flexible and practical and at the same time not introduce drastic changes which might inflict serious loss upon manufacturers and dealers in electrical supplies. The National Electrical Code, in conjunction with the Underwriters' Laboratories, has kept in close touch with the manufacturers of electrical fittings and materials so that it has been a difficult matter for doubtful or unsatisfactory material to be marketed. The Laboratories enjoy an enviable reputation for absolute fairness and their approval is generally accepted without question both in the United States and Canada. The National Code has furnished the bulk of the rules of the new hydroelectric regulations now under consideration, because it was found that the adoption of such Code rules as have been selected is in every way appropriate. But the National Code is somewhat complicated; in a general way it attempts to cover every conceivable form of electric wiring. There are a lot of recommendations, many "shoulds," frequent repetitions and a great variety of cross references. The new hydroelectric rules attempt to be very positive and specific and to leave out confusing recommendations and suggestions. Under the Power Commission Act every municipality in the provinces must provide a sufficient and proper number of inspectors to enforce the rules adopted, and the interpretations of these rules will be uniform. The rules have not been drafted with the idea of covering all forms of construction, large and small, as is the case in the National Code. They cover such general inside wiring as will be met with in every-day practice. A great many new rules not found in the National Code are included and rules relating to any particular class of construction are brought together in groups as far as possible. For example, switchboard construction is covered by five consecutive pages of rules; rules grouped on two pages cover transformer installation very completely; on one page there is brought together practically all the rules referring to cutouts, switches and circuit-breakers. The same general classification and arrangement is adhered to throughout the book. Another important matter which the new hydroelectric rules give careful consideration is the life hazard of defective wiring. Many new rules not included in the National Code at all are inserted here with a view to the better protection of ignorant or careless persons who may be exposed to live electrical conductors.

The discussion was opened by L. B. Hood, who found the rules generally good but called attention to several inconsistencies. The rules called for grounded neutrals with no fuses in the neutrals and then required switches and circuit-breakers in the neutral leads. The switch called for between the meter and service entrance bars out all opportunity for sealed service equipment. It would be better to specify 10-ampere fuses for branch circuits rather than six-ampere fuses.

A. A. Dion inquired as to what would occur if municipalities objected to grounding on the water pipes. Mr. Strickland replied that the Hydro-Electric Commission would override the municipalities. He pointed out further that the rules as published were put out with the expectation that weak spots would be discovered and stated that the Commission would welcome criticisms.

It was further brought out in the discussion that if a municipality provided the inspectors and was at the same time operating a municipal plant, then the privately owned central station would be subject to the inspection of its competitor.

The next paper was by S. Bingham Hood, entitled "Underground Distribution for Small Cities."

Underground Distribution for Small Cities.

This paper covers the subject which its author essays to treat in a very practical way, numerous cuts and other workable data being included. Mr. Hood contends that the demand on the part of the public that the central-station company place its lines underground is frequently largely due to the fact that the company is careless in the matter of maintaining a neat workman-like class of overhead construction; a class of work based on the old telegraph standards of 30 years ago is not unusual. This sort of thing is inexcusable now that such a complete line of high-class fittings for aerial lines is available at a moderate cost. The writer gives data which show the relative costs of underground work where the conductors are drawn into conduits as compared with work in which lead-covered cables are laid directly in the ground. In a problem assumed to be applicable to the average small town it is estimated that a saving of 40 per cent may be realized by the adoption of the latter class of construction. Lead cables laid solid in the earth are not subject to any deterioration other than would exist if the cables were pulled into a draw-in system. For years it has been common practice to lay lead pipe water services directly in the ground; we should be able to get as good service out of lead pipes containing electric conductors, as out of water pipes, if the work is put in with equal care in both cases. The draw-in system, however, is the more flexible of the two. In England the solid system of mains is almost universal practice, and, at double our standard voltage, it is given every satisfaction. The writer goes on to consider the selection of a system of distribution suitable for a small city where the outlying districts have overhead lines and the denser sections underground distribution. Here the transformers are unusually located on poles at street corners and the secondary leads extend to underground mains. An arrangement especially recommended consists in running three-wire mains on both sides of the streets and feeding them from both directions. Plans for looping these in at the most important services and the best methods of making the connections between the transformers and the mains are explained in detail.

This paper attracted a great deal of interest and was very favorably received. Messrs. Pratt, Angus, Dion, Croucher, Mudge and Marshall entered the discussion. The latter did not agree with the choice of unarmored cable. He did not consider the board an ample protection and in moist soils cables were likely to be subjected to acids due to the presence of peat.

The session on Thursday morning opened with a paper by L. Burpee, entitled "Magnetite Street Lighting." This and a paper by T. J. Pace on "Flame-Carbon Arc Lamps" were discussed together.

Flame-Carbon Arc Lamps.

The paper by T. J. Pace points out that in so far as high intensity of illumination was concerned the short-burning flame carbon lamp was readily accepted and filled a long felt want, however, the short life of the carbons —approximately 15 hours—retarded the general adoption of this lamp on a large scale. The metallic-flame lamp was next developed and although this lamp gives very desirable illumination both with respect to quantity and quality it is inherently limited in its application as it must necessarily be confined to direct-current circuits. The development of the long burning flame carbon arc was the next step in the development of arc lamps. With this lamp most any commercial color may be obtained, by the use of suitable carbons, and its efficiency as an illuminant is particularly high. The mean low hemispherical candlepower per watt varies from 2.5 with white carbons and Alba glassware to 5 mean lower hemispherical candlepower per watt with clear glassware. When opalescent globes are employed the efficiency falls between these values.

The paper presents curves showing comparative illumination of various arc lamps and describes the construction and operation of the lamp in question. The long-burning carbon arc is designed to operate on series and multiple alternating and direct-current circuits and in multiple-series on direct-current power circuits. A table presented in the paper shows the hours life per trim to be 110; cost of carbons

per trim to be $0.17; carbon cost per year, (4,000 hours), $6.18; and cost of labor for trimming at 4 cents per trim, $1.60.

A. L. Mudge expressed his appreciation of these papers, which are valuable inasmuch as both types of lamps will give better results than the five-lamp tungsten clusters which are becoming prevalent for business sections. He raised the question as to whether the better illumination above the horizontal would interfere with sign illumination.

M. D. Hastings inquired whether the magnetite lamp would flicker on a 25-cycle circuit.

In reply Mr. Burpee said that the rectifiers used with these lamps produced an undulating current having a frequency of 50 cycles.

John C. Parker then presented a paper entitled "Electricity on the Farm."

Electricity on the Farm.

This paper analyzes the advantages of using electric power on the farm and points out the considerations which must be taken into account in attempting to develop this field. Most farm operations to which electric power can be applied are of short duration, so that the load-factor is small and the cost of energy is, too, a small part of the total cost, depreciation and interest on investment being much more important. Illustrations were given to emphasize this point. It is, consequently, desirable to have apparatus which is rugged, simple and cheap rather than that which is technically of a high order and electrically efficient. The present high cost of installation has been a large obstacle to development in this direction. The type of trade literature which has been put out is not the proper kind to attract the farmer. The latter must be convinced that the use of electric power is really an industrial and economic proposition. Irrigation pumping is one of the most promising uses of electric power, even in eastern farm districts which ordinarily depend upon rainfall. More intensive cultivation and greater yields are made possible by this means. The use of irrigation, however, must be accompanied by other essentials to get the best results. The greatest appreciation of the electric motor will come through the scarcity of farm laborers, since the problem of securing even indifferent, unintelligent and unskilled help is becoming greater each year. The use of an electrically heated wire for safe cutting of limbs of trees and pruning was suggested. In spite of the lack of present accomplishments in this direction, the author prophesied great development in the near future and stated that farm business is worth going after if properly handled. Some old traditions must be abandoned in doing this. Line construction must be cheapened, inexpensive protective apparatus used and, if necessary, close regulation and continuity of service sacrificed. Transformers will have to be pushed to their extreme overload capacity. The wiring installations on the farms must be of the most inexpensive sort. Ruggedness and simplicity is the first consideration, initial cost the second, whereas lowness of power consumption is of less importance.

Mr. McClellan stated that rural business had been instituted in Belleville three years ago and after trying flat rates it was found better to change to a meter rate. He suggested placing advertising in journals that reach the farmers.

Mr. Philips suggested that central stations do their tree trimming by the hot-wire method developed by Mr. Parker, thus advertising their own wares.

Executive Session.

An executive session was held on Thursday afternoon, at which A. L. Mudge, F. G. Clark and W. G. Angus were appointed a committee of three to meet representatives of the Hydro-Electric Commission of Ontario and discuss the new rules and regulations for electrical installations which have just been issued by the Commission. This was in reply to a request from F. A. Gaby, electrical engineer of the Commission, that such a committee be appointed.

The election of officers resulted as follows:

President, D. R. Street, Ottawa, Ont.; first vice-president, A. L. Mudge, Toronto, Ont.; second vice-president, D. H. McDougall, Toronto, Ont.; third vice-president, Wills Maclachlan, Belleville, Ont.; honorary secretary, T. S. Young, Toronto, Ont.; secretary-treasurer, H. G. Martin, Toronto, Ont.

Managing Committee: A. A. Dion, J. S. Gould, F. G. Clark, L. Pratt, R. S. McDonough, H. G. Mathews, E. L. Miliken, W. L. Bird, A. E. Dunlop, R. M. Wilson, R. H. Sperling, R. J. Smith, W. G. Angus, W. S. Robertson.

The session on Friday morning opened with a paper by Stephen G. Thompson entitled "The Electric Vehicle." This was followed by a paper by C. Rummel entitled "Electric Vehicles From the Central-Station Point of View." The two papers were discussed together.

The Electric Vehicle.

The paper by Stephen G. Thompson states that the electric pleasure car has not been more generally adopted because of its high relative first cost as compared with the gasoline machine for similar service. The electric commercial car has, however, made rapid advances and today less than 10 active electric-vehicle manufacturers are marketing over 20 per cent of the total number of commercial power wagons employed—this in competition with over 300 makers of gasoline trucks. The field for the electric is clearly defined, namely for city delivery where frequent stops are made. Under these conditions the electric of moderate speed capacity will move faster than a higher speed gasoline truck. Lower cost of operation is also a point in favor of the electric. For the electric vehicle the average cost per car-mile for maintenance increases only 13.33 per cent over a period of four years, while that of the gasoline increases 362.5 per cent, according to data collected by the author. Also, the maintenance cost of the electric at the end of the four-year period was less than 50 per cent of that of the gasoline.

Electric Vehicles from Central-Station Point of View.

Mr. Rummel's paper gives a review of the electric-vehicle situation in the cities of Vancouver and Victoria, B. C. The utility company there was reluctant to enter into the business of selling vehicles, but it was found that agents handling both electric and gasoline cars made very little effort to exploit the former. Particularly was this so in connection with the selling of commercial cars. The first attempt to sell any car of this type in Vancouver was about seven years ago, a five-ton electric truck being purchased at that time and, although suffering from lack of proper attention, this car is still in active use. The central-station company purchased three electric trucks last year and these gave highly satisfactory service during the severe weather of last winter, which included the heaviest snowfall known in that region for over 15 years. The regular agents also prefer to having nothing to do with garaging of trucks. Therefore the company decided to take up an agency for commercial electric cars. An electric-vehicle expert was secured who devoted his time to the development of the business with the aid of extensive advertising. A very effective method followed was to offer one of the company's trucks to a prospect for an ordinary day's delivery service. The chassis of the car is usually ordered alone and the vehicle body is built at a local establishment to suit the desire of the purchaser. This is both for the purpose of saving on the import duty and also to more closely meet the ideas of the purchaser as to style, dimensions and construction of top of the truck. The company is building a garage, 110 by 94 feet in area, in the central part of the city; it has a 45-kilowatt charging outfit. The charges for garaging trucks are as follows:

Capacity of Truck	Monthly Garaging Charge
750 pounds	$45
1,000 "	45
2,000 "	55
4,000 "	60
7,000 "	65
10,000 "	70

These charges cover the supply of current for the batteries, storage of the car, daily washing and oiling and making of minor adjustments. Every central-station man should know, if he can conduct an electric garage where he can induce the merchants to bring their trucks and carry away his current, that this not only saves the cost of distribution lines but that it provides a load absolutely under his own control in the matter of delivery, since the majority of the wagons can be charged after nine or ten p. m. In Vancouver the rates made for current are so low as to leave practically no room for competition from either horse or gasoline wagons; the original cost of an electric truck in that city

has been rather high, however, and Mr. Rummel therefore urged in conclusion that efforts be made to reduce the first cost of the car.

The discussion was opened by J. D. Lachapelle, who told of the experiences of three companies in Montreal where trucks were operated over rough roads, and stated that nearly all of the repairs were to the rubber jars of the batteries.

A. A. Dion pointed out that the tariff duty made the prices of cars high in Canada, where gasoline cars are offered at much lower prices.

Mr. Keiser had found the cost of current for a two-ton electric truck to average 1.8 cents per mile and the total cost to equal six cents per mile. This is based on a rate for current of four cents per kilowatt-hour for the first five charges per month, three cents for the next five, and two cents for the remainder. It is necessary to keep the battery warm in cold weather.

R. A. Merritt stated that in Toronto regular power rates were used for charging vehicles as follows: five cents per kilowatt-hour for the first 50 hours' use of the maximum demand in each month, one cent per kilowatt-hour for the next 50 hours' use, and one-half cent for the remainder. There is a discount of ten per cent for prompt payment. These rates are equivalent to from $10 to $12 per vehicle per month. The company is installing motor-generator sets for public garages or for private residences on easy long-term installments.

A. B. Lamb called attention to the fact that some of the cities in the Middle West, such as Saskatoon and Calgary, are installing electric fire engines.

Stephen L. Coles, of the Society for Electrical Development, then presented a paper entitled "Service."

Service.

In this paper Mr. Coles emphasizes the importance of giving the most perfect service possible. The success of a central station, not only as a public utility but as a business proposition, is in direct ratio with the kind of service it gives. Its dividend rate is to a large extent dependent upon this. It is only within the past ten years that the vital importance of service has received the attention of central-station men. This appreciation has grown so rapidly, however, that nowadays the abandonment of the term "central station" is urged for the term of "service company" Moreover, the public is becoming sufficiently informed to demand and to insist upon service. Failure to meet this demand immediately impairs the good will of the company and ultimately may bring about competition. The most valuable asset a central station can possess is the good will of the public it serves. This good will may be increased to a wonderful extent by constant improvement of every detail of service.

This was discussed by Messrs. Lamb, Monroe, Dion, Magalhaes and Ostram. It was pointed out that complaints should be handled by intelligent persons; that customers should be helped out with motors in times of trouble; and that emergency crews should be maintained to investigate household troubles, such as grounds, burnt-out fuses, etc.

A paper on "Central-Station Advertising" was then presented by D. H. McDougall.

Central-Station Advertising.

In opening his paper, Mr. Mc Dougall points out that there are two general meehods of advertising, the first of which is by direct contact with the public and the second by various kinds of printed advertisements. The latter, in order to be effective, must be read and must be true to the facts. If the public believes there is something extravagant about a company's advertising it immediately becomes suspicious of the company itself; consequently, such advertising may really be detrimental instead of successful. Taking up the class of direct advertising by immediate contact with the public the author showed that next to actual dilivery of the goods, that is, providing perfect service, courtesy on the part of every employee is the best method of advertising the company's business. Direct personal canvass by agents and salesmen depends to a very lage extent on the efficiency of these representatives; it also depends on the truth of their statements. These men must be taught not to make any promises that the company cannot fulfil. The complaint department is one of the most important branches of the company's business. The man entrusted to handle complaints must be selected with the greatest care. In the line of printed advertisements there are several classes of which the first is by a monthly house organ by circulars, letters, pamphlets and other printed matter sent direct to selected prospects or others it is desired to interest. This class of advertising is sure to reach those it is intended to, because postal service is quite reliable.. However, in order to be effective, such printed matter must be carefully selected and tastefully set up so as to be so attractive that it will not only be read, but, if sent out regularly, be looked for. The second class of printed advertisements are those appearing in the daily press. Such can be made very effective if the reading public is at all sympathetic, but as a means of converting an antagonistic public Mr. McDougall thought it was of very doubtful value unless the papers themselves are fair and unbiased toward the company. Electric signs, bill posters and street-car announcements come next in order; of these the electric sign should be placed first, as an electric company should practice what it preaches; such signs should be dignified and free from flamboyant features. Properly illuminated bill posters should serve as a good medium. Street-car advertising is somewhat effective, but better adapted for advertising appliances than any other branch of the business. In the fourth division are weekly newspapers and magazines; these are more likely to be read more thoroughly and less hurriedly than the daily papers. The final class of printed advertising is that on theater programs, baseball score-cards, various entertainment programs, etc. The very best method of advertising the company's business, however, is by the service it gives.

This was discussed by Messrs. McIntyre and Pratt. Window displays were favored; also a four-page monthly magazine. Results from billboards had been disappointing.

At the afternoon session a paper on "Pole-Type Transformers" was presented by C. E. Sisson.

Pole-Type Transformers.

This paper calls attention to some of the more important details entering into the design and construction of the modern lighting transformer, both from an operator's and manufacturer's point of view. Safety, durability, economy of operation and first cost are discussed. It is pointed out that as there cannot be any important improvement in copper or in the steel used in the manufacture of transformers, no higher efficiencies than those at present obtained can be expected. Long life and continuous service are the points being given the greatest consideration by engineers and manufacturers.

This was discussed by Messrs. Hood, Mudge, Dion, Lamb and Pratt. The use of such transformers was favored and it was suggested that it would be an advantage if manufacturers provided taps which would allow for five or ten per cent variation in voltage at the end of long distribution lines.

The report of the Commercial Committee was then presented by L. Pratt. A letter asking for data had been sent to all Class A members and the replies were to be published later.

Entertainment.

On Wednesday evening there was a theater party at the Royal Alexandra Theater. On Thursday morning there was an automobile ride for the ladies with luncheon at the Royal Canadian Yacht Club. In the afternoon a baseball game between representatives of the central stations and the manufacturers resulted in a victory for the former by a score of 11 to 4. In the evening there was a cabaret entertainment at the Temple Building, followed by dancing. The talent at this show was supplied by the Toronto Electric Light Company and the Toronto Hydro-Electric System. On Friday evening there was a rejuvenation of Jovians, at which 38 candidates were initiated.

Copper Exports.

Exports of copper for the week ending June 26 equaled 5,228 tons; since June 1, 25,341 tons; same period last year 21,930.

New Electrical and Mechanical Appliances

C & C Electric Arc Welding Apparatus.

The foundry cost of producing large or intricate castings is usually very high due to spoilage from shrinkage cracks, blowholes, etc. Through the perfection of electric arc welding such defects are now readily remedied and cracks easily repaired in street-car trucks, locomotive frames and other structures or machine parts. These and many other useful adaptations of arc welding have called for apparatus to facilitate the process and to insure its perfect control, and to this end the C & C Electric & Manufacturing Company, Garwood, N. J., has bent its energies with the resulting development of a complete and reliable equipment.

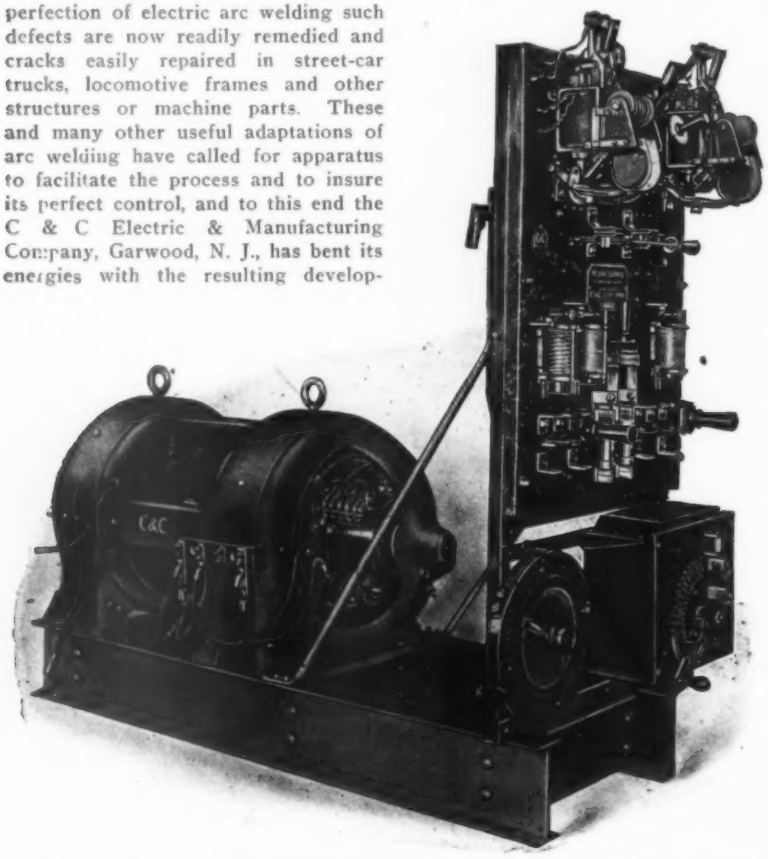


Fig. 1.—Motor-Generator and Control Apparatus for 300-Ampere Arc Welding Outfit.

In the C & C arc welding system a direct-current arc is employed at a pressure of 10 to 60 volts. In order to produce this current economically and with ease of control, a motor-generator set is provided in which the motor can be supplied for direct-current or alternating-current circuits of any voltage, frequency and number of phases. This motor is directly connected to a specially wound variable-voltage dynamo with liberal commutator surface. Fig. 1 shows such a motor-generator set typically mounted on a double I-beam base together with switchboard or control panel. This panel includes main-line and motor-starting switches, a dynamo-field rheostat, a current regulator, an automatic series relay in each welding circuit which operates a magnetic switch to prevent short-circuiting the generator, besides the necessary instruments, resistances, etc. If desired, two or more welding circuits may be run from the same set for use by as many independent operators; in this case each circuit is separately regulated. The equipment also includes a head shield and eye-protected sighting hood for each operator, electrode holders and hand shields of several types, one of which is shown in Fig. 2.

In this welding process one welding terminal is clamped to the work and the other is in the form of either a graphite or metallic electrode. The former type is used for various kinds of welding, such as filling in and building up, and also for cutting; in this case the welding or filling-in metal is supplied from an outside source, usually a rod of soft iron or steel which the operator holds in his free hand and inserts into the arc so as to be fused into a homogeneous mass with the parts being welded. When a metallic electrode is used a lower voltage suffices and in this case the electrode itself is fused and fills in the crack and makes the weld after the parts have become thoroughly heated. In the latter method work can be done on vertical or even overhead surfaces. The control equipment is so arranged that metallic and graphite electrodes can be quickly interchanged and the necessary circuit adjustments easily made on the switchboard. When the welding circuit is broken, the automatic series relay already referred to introduces a resistance in series with the electrode so that when the latter is brought into contact with the work only enough current passes to properly form the arc; as quick as the arc is drawn this resistance is automatically cut out of

Fig. 2.—Head Shield and Graphite-Electrode Holder with Hand Shield.

the circuit and practically the full voltage of the welding circuit applied at the arc between the electrode and the work, thus preventing short-circuits and unnecessary losses and insuring high efficiency.

Figs. 3 to 6 show a few samples of arc welding with the C & C apparatus, before and after the weld was made. Tests made repeatedly show great strength in the welds, the specimens breaking at other places than where the weld was made. The manufacturers state that this process is not only a reliable one but highly economical.

Fig. 3.—Broken Lower Section of Engine Frame.

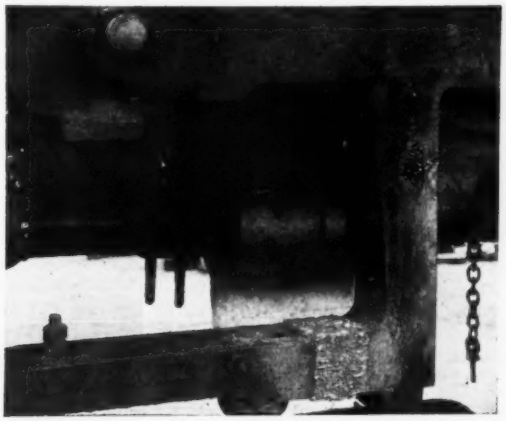


Fig. 4.—Same Section Electrically Welded and Reinforced.

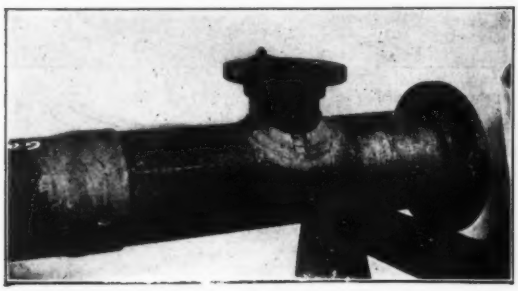
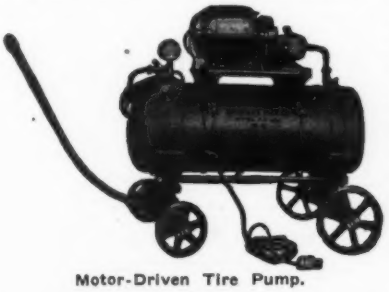


Fig. 5.—Two Pieces of Pipe and Branch Outlet Ready for Welding.

Fig. 6.—Pipe Sections and Branch Welded Together.

Portable Motor-Driven Automobile Tire Pump.

The portable motor-driven tire pump has been received with great favor by automobile owners and garages. It is brought to the car needing service so that its use eliminates the expensive, complicated and leaking air lines necessary with stationary installations. In private garages it furnishes complete relief from the back-straining labor of hand pumping and enables the automobile owner to keep his tires at the pressure specified by tire manufacturers.



Motor-Driven Tire Pump.

In the outfit illustrated, the small motor-driven air compressor is mounted upon the storage tank, the entire outfit being mounted on wheels. The compressor is driven by a one-quarter horsepower Westinghouse motor which is operated from an electric light socket.

The whole outfit is self-contained and ready for operation the moment it is uncrated. It is provided with a pressure gauge, 12 feet of high-pressure air hose, and an automatic tire connection, which shuts off the air when removed from the valve of the tire. The whole outfit has been made with great care and it is thoroughly air-tight. The pump is made by the Brunner Manufacturing Company, of Utica, N. Y.

New Push-Button All-Porcelain Socket.

A new design of all-porcelain push-button socket, shown in the accompanying illustration, has been placed on the market by the Cutler-Hammer Manufacturing Company, Milwaukee, Wis., to replace its former socket which bore the number 7,400. This socket, which has the same number, is smaller than the earlier type, and is much easier to install. The casting consists of two halves, to one of which the mechanism is permanently attached. To wire the socket only one screw need be loosened, which then allows the halves to be separated and makes the two binding-screws, to which the cord is attached, easily accessible. A reducing bushing for the cord is supplied and provision made for standard socket shade-holders.

The mechanism which can be seen when the socket is being wired is of the ingenious quick-make-and-break type that is employed in other Cutler-

New Push-Button Porcelain Socket.

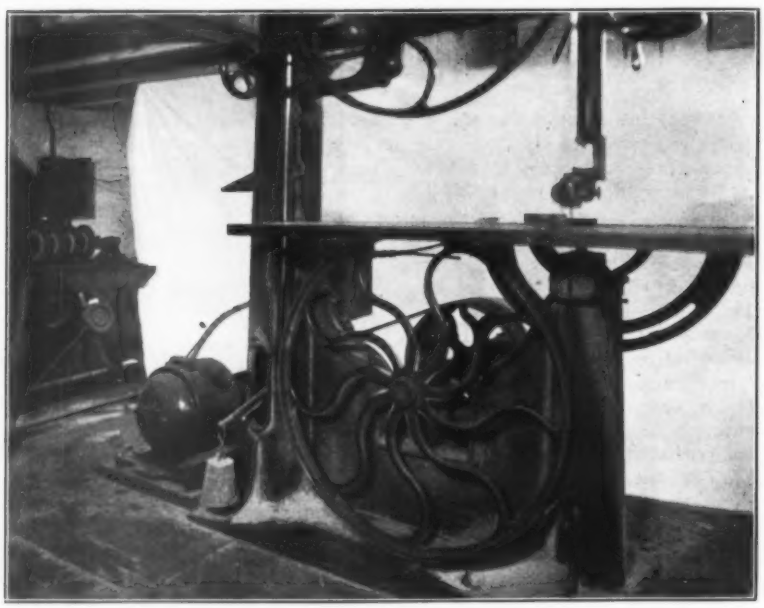
Hammer switches. The indicating operating bar is placed where the thumb and finger are naturally placed when grasping the socket. As the push-bar is in a horizontal plane the socket is not twisted or jarred when operated and only one hand is required. The push-bar has a light button at one end, pressure on which turns on the current, while at the other end there is a black button, pressure on which turns off the current.

The high rating of 660 watts, 250 volts, makes this push-button socket particularly well suited for use with heating and cooking appliances and small motor-driven devices; also for basements, laundries and other locacations where dampness is liable to be present, the shock-proof porcelain casing makes this socket desirable. The standard finish of the casing is gray, although brown, ivory and white can be furnished. These sockets bear the label of the Underwriters' Laboratories.

As there is a demand for a socket of this kind for fixture work it is understood that this model with one-eighth-inch, one-quarter-inch, and three-eighths-inch brass nozzles is in preparation.

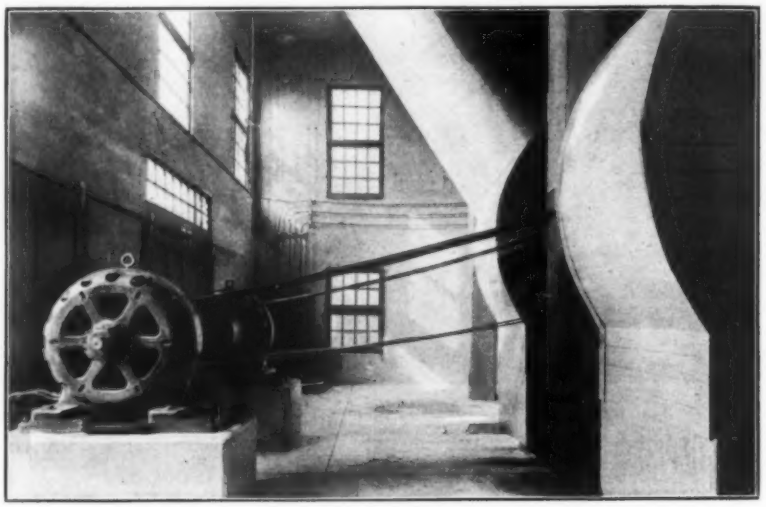
Wholly Inclosed Motors in the Woodworking Plant.

Wholly inclosed motors are now deemed a necessity in a woodworking shop and the slight additional cost in manufacture is repaid many times over in the security from damage by fire and the elimination of boxing in with zinc-lined protective cabinets. In the illustration herewith is shown a totally inclosed motor with automatic controller operating a band saw in a prominent woodworking shop in Philadelphia. The motor is fitted with solid cast-iron end bonnet on the pulley end and provided on the commutator end with wholly inclosing doors which lock with a wing-nut latch and are hinged to open on either side. In this manner ready access to the commutator is gained. An inclosing block of porcelain protects and insulates the terminals of this motor so that a hammer or other tool accidentally dropped on top of the motor does not endanger the shop through arcing or the motor itself through short-circuiting, the former being exceedingly dangerous where so many inflammable particles are constantly floating through the air.



Inclosed Motor Driving Band Saw.

This motor, although wholly inclosed, operates at a temperature rise of less than 50 degrees centigrade under continuous full-load operation. The motor is rated at two horsepower when running at 1,100 revolutions per minute, and supplied with 220-volt direct current. It is manufactured by the Diehl Manufacturing Company, of Elizabeth, N. J.



Motors Driving Blowers for Pre-Cooling Fruit Cars.

Pre-Cooling of Refrigerator Fruit Cars.

The illustration herewith shows one of two sets of two seven-foot Sirocco blowers driven by 75-horsepower Westinghouse motors which are used by the Pacific Fruit Express Company, Roseville, Cal., for pre-cooling fruit cars previous to filling their refrigerators with ice.

Air is drawn from cooling rooms, in which the temperature is kept at about 18 degrees Fahrenheit by direct-expansion ammonia coils, and is forced into the cars, thus reducing their temperature and effecting a considerable saving in ice during transportation.

By means of specially designed valves, also driven by Westinghouse motors, the air current can be reversed so that the fans can exhaust stagnant air from the cars previous to pre-cooling.

Motor drive is used extensively in this plant, being employed for the brine-tank agitators, ice elevators, chain conveyors for loading and unloading, pumps, and miscellaneous machines in the repair shop.

Canadian Water Powers.

Canada's water power is estimated at 16,600,000 horsepower, equal to an annual production of 36,700,000 tons of coal; only 1,016,521 horsepower has been developed.

Current Electrical News

LIGHTING AND POWER.

(Special Correspondence.)

WALL LAKE, IOWA.—Electric light bonds carried at the special election. C.

WASHINGTON, IOWA.—A new lighting system will be installed here, it is reported. Z.

ELIZABETH, MINN.—Plans are being made for the installation of an electric lighting system. C.

PARMA, OHIO.—This city will install a cluster lighting system on its principal streets at once. O.

FORT MADISON, IOWA.—A 25-year franchise has been granted to the Fort Madison Electric Company. C.

BAY CITY, ORE.—The City Council recently granted an electric lighting franchise to the Bay City Land Company. O.

MONONA, IOWA.—Wellman and Son have been granted a franchise to construct and operate an electric light plant here.

OLYMPIA, WASH.—An electric light and power franchise has been granted Millard Lemon and Wilbur B. Foshay.

COMMERCE, TEX.—The Council is planning to establish a $10,000 light and water system. The mayor has the matter in charge

COUER D' ALENE, IDAHO.—The question of installing a municipal light plant was favored at a recent meeting of the City Council.

SAN DIEGO, CAL.—The San Diego Gas & Electric Company is planning to expend $459,000 for extensions. Address C. C. May for information.

JOPLIN, MO.—The Council is planning to issue $75,000 in bonds to extend the electric system. Address John J. Saunders for information.

ELLSWORTH, MINN.—$8,000 in bonds has been voted for the construction of a municipal electric light plant here. Address the city clerk.

KANSAS CITY, KANS.—$200,000 has been voted for a municipal electric plant. Address James E. Caton, finance commissioner, for further particulars.

BELLINGHAM, WASH.—The City Council has gone on record as being in favor of municipal ownership of a projected light plant on the Nooksack River.

MONMOUTH, ILL.—The Commercial Club and the Public Service Company will establish boulevard lighting. Address Mayor Brown in regard to the matter.

ELK POINT, S. D.—The city council has engaged Earl Jackson, of St. Paul, Minn., to draw plans and estimates for the installation of an electric light plant. C.

PLACENTA, CAL.—The residents of this place have petitioned the Board of Supervisors to take action that will lead to the forming of a street lighting district here.

SAN LUIS OBISPO, CAL.—Steps will be taken immediately for the improvement of the Arroyo Grande plant of the San Luis Obispo Light & Power Company.

BIG WELLS, TEX.—Big Wells Water, Light & Power Company has been incorporated with a capital of $10,000 by Paul C. Levering, H. C. Zeigler, and S. A. Armstrong.

EGAN, S. D.—A franchise has been granted to the Flandreau Light & Power Company for a period of 20 years. The company is owned by St. Paul, Minn., parties. C.

PHILADELPHIA, PA.—The city of Camden, N. J., is proposing a municipal electric lighting plant. In addition to serving 790 arc lamps the plant would furnish commercial service. N.

SAN FRANCISCO, CAL.—The Pacific Light & Power Company has applied for permission to issue $2,500,000 of its preferred stock, the proceeds to be used on its Big Creek hydroelectric project.

OHIOWA, N E B.—Announcement has been made that F. Lapcheska has secured a franchise to operate an electric lighting system here, and that the system will be installed as soon as possible.

DAYTON, ORE.—The city proposes constructing a municipal water system. Jones & Flagg, consulting engineers, of McMinnville, Ore., have been retained to prepare plans for the improvement. O.

BLUFFTON, IND.—The Public Utility Commission has been granted permission by the city to issue $20,000 of bonds for the improvement of the municipal electric light plant. Address the city clerk.

EAST PERU, IOWA.—The Peru Electric Light & Power Company has been granted a franchise to construct and operate an electric light plant and system at East Peru. F. A. Herweke is superintendent.

BROWNING, ILL.—The Village Board has granted a franchise to the Central Illinois Public Service Company, Mattoon, Ill., to sell light and power in Browning. A transmission line will be built from Beardstown to this place. Z.

FOREST CITY, ME.—F. C. Foster and G. W. Gould, of this city, are reported as expecting to develop several hundred horsepower of electrical energy on the Eel River, a tributary of the Meductic River in New Brunswick.

HARRISON, ARK.—The franchises and plants of the Harrison Electric Light Company and the Harrison Water Works system have been sold to C. L. Henderson and J. O. Nelson, who will spend $10,000 in extensions and improvements.

LAKEVIEW, CAL.—The Sierra Power Company, operating in this section, has secured property here and will, in the very near future, install machinery for giving Lakeview people the best lighting and power service that can be secured.

KITTERICK, CAL.—The San Joaquin Light & Power Company has found is necessary to double the capacity of its plants in this city and Taft. The apparatus to be installed will mean 2,000 horsepower for Kitterick and 4,000 horsepower for Taft.

WELSH, LA.—It has been decided to prepare for a bond issue for the purpose of installing a municipal electric lighting and waterworks system. R. S. Greer is mayor of the town and Dr. John H. Cooper is chairman of the committee which was appointed to investigate the matter.

KEARNEY, MO.—At a special election held for the purpose it was decided to grant a franchise to John A. Eby, T. H. Henderson and Lou Major for furnishing electric lights in Kearney. The plan is to obtain the current from the Excelsior Springs plant, and it is expected that the work will be completed in a couple of months.

NIAGARA FALLS, N. Y.—The Shredded Wheat Company will install decorative lighting about its factory, erecting lamps in Buffalo Avenue, Fourth and Sixth Streets. Eventually the system will be extended along the rear of the plant in Jefferson Avenue. Frank Meyer, master mechanic of the company, has charge of the matter.

REDLANDS, CAL.—At a recent meeting of the City Trustees steps were taken looking toward the construction by the city of a $6,000 power line from the city limits to the pump plants of the municipal water system to cary out the contract with the Southern Sierras Company to furnish power for operation of the pumps at the wells.

RATHBONE, O.—The State Board of Administration has decided to erect a power plant at the Girls' Industrial Home. It is the purpose of the board to erect a plant so that sufficient power can be generated to do all the necessary power work about the institution and also to furnish a new lighting system. Address W. E. Painter, chief engineer, for information.

PIEDMONT, CAL.—A report on the cost of a proposed municipal lighting system with underground wires has been submitted by the City Engineer, showing that a system covering about 11 miles of streets, with arc lights, will cost $44,000 and $20,000 for poles and wires. A tungsten system covering the city could be installed for $51,000, with poles and wires costing $22,500.

BELLINGHAM, WASH.—The City Council has asked the Secretary of the Interior for permission to make application for certain power rights on the Nooksack River where certain mineral claims, held by the Puget Sound Traction, Light & Power Company, had been revoked by the federal court. Pending the receipt of an answer, investigation will be made as to the city's rights, cost of construction and many other matters connected with the operation of a municipal power plant. C.

STORY CITY, IOWA.—The Electric Department of this city is about to make substantial improvements to its power house. It is proposed to build a new fire-proof building, and entirely rearrange the machinery. The city will be in the market for a Corliss engine, fire tube boiler with all the necessary piping, belts and other equipment. The bonds to cover this improvement will be voted on July 8. Plans and specifications are being prepared by W. H. Grover, electrical engineer, Ames, Iowa.

BEAVER, PA.—It has been announced that charters are asked by Arthur McKean, Joseph A. Tritscher and John A. Elliott, of Three River Falls, for the Ellwood City General Electric Company, Wampum General Electric Company, Perry General Electric Company, Beaver Township General Electric Company, and the Wayne General Electric Company. Although nothing definite has been given out as to the purpose of these companies it is understood that a power plant will be located somewhere on the Connoquenessing Creek.

TELEPHONE AND TELEGRAPH.

(Special Correspondence.)

DALTON, GA.—The Dalton Telephone Company proposes to improve its system.

HARRISON, ARK.—The Boone County Telephone Company will incorporate with a capital stock of $25,000.

PETALUMA, CAL.—At the annual meeting of the Petaluma Rural Telephone Company it was decided to build various new lines.

GOLDSBORO, N. C.—The Falling Creek Telephone Company has been incorporated with a capital stock of $10,000 by J. B. Kennedy, G. E. Grantham and others.

McALESTER, OKLA.—The Postal Telegraph Company, C. H. Mackay, New York, president, is planning to construct additional telegraph lines aggregating 667 miles.

TAMPA, FLA.—It is said that City Electrician Fitzgerald is preparing plans for placing the police and fire-alarm system underground in certain sections of the city.

PIERRE, S. D.—New Era Farmers' Telephone Company has been incorporated with a capital of $10,000, by Olaf C. Sorenson, Michael Jones, Freeman Faust and C. F. Lucas. C.

YALE, S. D.—Winthrop Telephone Company has been incorporated with a capital stock of $1,200 by Jacob J. Thahetter, Jakob J. Decker, Zacharias Kleinsasser, all of Carpenter.

BERTHA, MINN.—The Bertha & Aldrich Telephone Company has been incorporated by Hiram Kilburn, Rudolph Hasse and Albert Lind, W. E. Partlow, Charles J. Leave and others.

BANGOR, PA.—The Blue Mountain Telephone & Telegraph Company has been incorporated with a capitalization of $50,000. Oliver La Bara, this city, is the principal incorporator.

KEWANEE, ILL.—The Board of Directors of the Kewanee Home Telephone Company has voted to expend $8,000 for switchboard, cable and pole improvements, and $2,000 for instruments. Z.

DARRINGTON, WASH.—The Suiattle River Telephone Company will build a line from this city to the Suiattle River basin. The proposed line will run through the National Forests reserve. O.

WESTFIELD, N. D.—The Overland Telephone Company has been incorporated with a capital stock of $10,000 by Peter Borr, Andrew Olson, Pollock, S. D., and Gerrit Van Beek, Westfield, N. D.

COUER D'ALENE, IDAHO.—F. J. Davies, secretary of the Coeur D'Alene Timber Protective Association, Spokane, Wash., announces that 12 miles of telephone line will be constructed by the Association in this territory. Work will be ordered shortly. O.

ALHAMBRA, ILL.—Alhambra Mutual Telephone Company has been incorporated with a capital stock of $2,500 for the purpose of maintaining and operating telephone lines. The incorporators are C. Warber, Christ Rabberman, H. C. Henchen, F. W. Brumworth and others.

AURORA, ILL.—The City Council has granted a new franchise to the Interstate Telephone & Telegraph Company and the lines in the city will be rebuilt. The wires will be placed in underground cables. The work will cost about $75,000. L. C. Griffiths is general manager. Z.

ASOTIN, WASH.—A. H. Graves, owner of the local telephone system, contemplates the construction of a telephone line from this city to Rogersburg. The line will be approximately 24 miles long. Mr. Graves proposes to have the line built and in operation before fall. O.

CHICAGO, ILL.—The Chicago Telephone Company will spend $8,000 immediately upon its long-distance service in Lake and McHenry Counties. Since the absorption of the Lake County system by the Chicago Company last fall, a plan has been matured for the unification of the two long-distance systems.

RALEIGH, N. C.—The Wautaga Electric Company of Hickory has been granted articles of incorporation. The capital stock of the company is $50,000 and the incorporators are N. S. Dasher, J. L. Riddle, H. C. Menzies, K. C. Menzies and J. D. Elliott. The purpose of the company is to operate telephone lines, street railways and to sell energy for light and power.

MENOMINEE, MICH.—The present telephone system of the city of Menominee will be rebuilt. The estimate made some time ago by the Engineering Department of the Michigan State Telephone Company has been approved by the Board of Directors and it is expected the work of rebuilding will commence early in the fall. Address D. I. Dixon, manager.

ELECTRIC RAILWAYS.

(Special Correspondence.)

PORTLAND, ORE.—The Northwestern Electric Company plans the construction of a substation here. O.

MINNEAPOLIS, MINN.—The Minneapolis Street Railway Company has accepted a proposal to build 15 miles of track. C.

FREDONIA, N. Y.—J. Herbert Digby, of Dunkirk, N. Y., is interested in the construction of an electric railway to be built here.

GRAND RAPIDS, MICH.—The Grand Rapids Railway Company will extend its lines. Address Benjamin S. Hanchett, president.

BURLINGTON, IOWA.—The Tri-State Traction Company proposes to build a steam and electric line between Quincy and Burlington. C.

BROWNTOWN, MICH.—Arthur Greenway Company, of Detroit, has been granted a franchise to construct an electric railway through Browntown.

MT. VERNON, IOWA.—The City Council has granted a franchise to the Iowa Railway & Light Company to built on Main Street. Z.

OWENSBORO, KY.—Plans are being prepared by the Owensboro City Railway Company for extensions of its line on Breckenridge Street. Address G. R. Millican, superintendent.

PEORIA, ILL.—The Peoria County Board of Supervisors has granted a right of way through Peoria County to the Peoria, Canton & Galesburg Interurban Railway Company. Z.

EXETER, CAL.—Plans are being considered by the Visalia Electric Railroad Company for the extension of its line in Exeter. F. W. Webster, of Fresno, is general manager.

MILWAUKEE, WIS.—The Milwaukee Electric Railway & Light Company is planning to construct an electric railway on State Street and Howell Avenue. Address R. B. Stearns, vice-president, for information.

WARSAW, ILL.—It is stated that Richard Oglesby Marsh, of this place, is actively interested in the Tri-State Traction Company, which, he says, proposes to build a steam and electric line between Quincy and Burlington.

SPRINGFIELD, ILL.—The City Council has granted a 20-year franchise to the Springfield & Central Illinois Interurban Company, which will build a line from this city to Duquoin to connect with a line between St. Louis and Terre Haute. Z.

CHAMPAIGN, ILL.—W. B. McKinley, of this city, who has purchased the Omaha-Papillion interurban line, is contemplating an interurban between Lincoln and Omaha. It is reported that Mr. McKinley will likely begin construction work next year.

MINNEAPOLIS, MINN.—A direct trolley line between Robinsdale and Minneapolis was ordered built by the Special Council Committee. The proposed line will come into the city by way of Crystal Lake Road and connect with the system at Twentieth Avenue. north.

BUHL, IDAHO.—J. Stewart Clark, of Twin Falls, who is agitating a proposition of constructing an electric railroad between Buhl and Wendell, *via* Haggerman, is authority for the statement that work of constructing the

line will begin shortly. The line will be 25 miles in length. O.

FRANKLIN, TENN.—The Middle Tennessee Traction Company has voted an amendment to its charter increasing its capital stock from $10,000 to $250,000. The company proposes to build an interurban line from Franklin to Shelbyville, 45 miles, and has nearly completed the grading work.

OAKLAND, CAL.—The officials of the Oakland, Antioch & Eastern Railway Company have made applications to the Railway Commission of this state for permission to issue $1,000,000 in 5 per cent bonds, the money derived therefrom to be used in the completion of the company's line from Baypoint to Sacramento.

OKMULGEE, OKLA. — Former Governor C. N. Haskell has made a proposition to citizens of Okmulgee for the building of a terminal line from Okmulgee to Coalton and Henryetta, on which interurban cars will also be operated. The committee in charge of the matter has recommended that the city issue $100,000 of park bonds, a part of the money to be used as a bonus for the new line. P.

TOPEKA, KANS.—Railway circles in this city are concerned over the knowledge that engineers and surveyors have been working toward Topeka laying out the preliminary plans for the construction of the Independence, Neodesha & Topeka Electric Railway. The building of this interurban has reached the stage where maps are completed, bonds voted for a part of the line and commercial organizations of cities all along the proposed route are actively interested.

NEW INCORPORATIONS.

HARRISBURG, PA.—State charters have been issued to the Forward Electric Company, capitalized at $5,000, and to the Jackson Electric Company, capitalized at $5,000.

TOLEDO, O.—The General Utilities Company has been incorporated with a capital of $60,000 by Frank E. Butler, George R. Haddock, Charles A. Butler, Edward W. Butler and E. Hitzman.

INDIANAPOLIS, IND.—The Circuit Terminal Railroad Company has been incorporated with a capital stock of $10,000 to take over the franchises and rights of the old Circuit Terminal Company.

NEW YORK, N. Y.—Ertha Electric Manufacturing Company, Incorporated, has been granted articles of incorporation with a capital stock of $20,000. The incorporators are Andrea Fumo, Ida Odea, Abraham Heyert, all of New York City.

PHILADELPHIA, PA.—The H. P. B. Electric Company has been incorporated with a capital stock of $50,000 to manufacture and deal in electrical machinery of all kinds. The incorporators are Robert C. Hall, Maurice E. Benton, Philadelphia; and Lansing W. Powers, Rye, N. Y.

BUFFALO, N. Y.—The American Engine & Electric Company has been incorporated with a capital stock of $800,000 for the purpose of manufacturing, constructing and maintaining engines operated by electricity, etc. The incorporators are Arthur S. C. Loepere, Joseph H. Morey, Buffalo; W. M. Pyle, Wilmington, Del.

FINANCIAL NOTES.

The California Railroad Commission has granted authority to the Pacific Gas & Electric Company to issue $5,000,000 general and refunding gold five-per-cent notes. Of this amount $1,590,000 is to refund promissory notes and the balance will be used for the Bear River power development. Permission also was granted for the extension of six notes of $25,000 each.

The Louisville Gas & Electric Company, recently organized by H. M. Byllesby & Company, to take over the Kentucky Heating Company, the Kentucky Electric Company, and other gas and electric properties in Louisville, has sold to Harris, Forbes & Company and E. H. Rollins & Company, New York City, $7,500,000 first and refunding five-year, five-per-cent bonds out of a total authorized issue of $15,000,000. Bonds will be dated July 1, 1913.

With the completion of arrangements for consolidating all of the gas and electric light and power companies in Louisville, Ky., the Continental & Commerical Trust & Savings Bank of Chicago and H. M. Byllesby & Company are offering a six-per-cent serial note issue of the Standard Gas & Electric Company. These notes are issued in denominations as low as $100 and are of one, two or three-year maturities. The Standard Gas & Electricity Company is the principal holding company of the Byllesby utility properties. Its earnings applicable after bond interest, are more than eight times the interest requirements of the present $3,000,000 note issue. A considerable portion of these notes has already been purchased by stockholders. Collateral specially pledged to secure the issue has a value largely in excess of the par value of the notes, which are followed by over $11,500,000 preferred stock. The proceeds of the note issue will furnish the Standard Gas & Electric Company funds for extensions and improvements at its present properties and will also enable it to materially increase its holdings in the Louisville Gas & Electric properties. The Standard Gas & Electric Company controls or has a large interest in twenty electric, gas and traction companies, serving 132 communities with a combined population of 1,526,000. These properties are located in prosperous communities in fifteen states in the West and South and have a combined earning power of about $12,000,000 a year.

The Louisville Gas & Electric merger is regarded as one of the most remarkable achievements of progressive utility management. It has been sanctioned by the city authorities of Louisville, Kentucky, and the Supreme Court of Kentucky, a new franchise having been granted by the city to enable the consolidation. Natural gas will be brought in from West Virginia fields. Unified management will be followed by marked economies in operation and increase of the service marketed. Louisville newspapers and representative citizens have welcomed the new Louisville Gas & Electric Company, the Louisville *Post*, for example, saying: "The new operators will make money in Louisville if they keep the community satisfied, and if they keep the community satisfied everyone should be pleased if they do make money."

The Canadian Electric Company, Limited, which owns and controls as subsidiary companies the Canadian Foundry Company, Limited, and the recently acquired Allis-Chalmers Company, will consolidate the selling organizations of these two, conducting both companies under the name of the Canadian Allis-Chalmers, Limited. Sales of electrical apparatus and supplies will be in the name of the Canadian General Electric Company, Limited, and general engineering contracts and sales of mechanical appliances in the name of the Canadian Allis-Chalmers, Limited.

Dividends.

Athens Railway & Electric Company, a quarterly preferred dividend of 1.25 per cent, payable July 1.

American Telegraph & Telephone Company; quarterly of two per cent, payable July 15 to stock of record June 30.

Associated Gas & Electric Company; quarterly of 1.5 per cent on preferred, payable July 15 to stock of record June 30.

Bay State Street Railway Company; a semi-annual first-preferred dividend of $3, payable August 1.

Boston Suburban Electric Company; quarterly of $1 on preferred, payable July 15 to stock of record July 2.

Chicago Railways Company; two dividends on Series 1 participation certificates, namely, six per cent, payable July 1 to stock of record June 27, cleaning up all the back dividend accumulation, and four per cent payable August 1 to stock of record July 23. The latter is one-half of the full dividend due this year.

Cincinnati, Newport & Covington Light & Traction Company, quarterly of 1.125 per cent on preferred and 1.5 per cent on common, payable July 15 to stock of record June 30.

Citizens' Traction Company, Philadelphia; a preferred dividend of two per cent, payable July 1.

Citizens Telephone Company, Grand Rapids; a quarterly dividend of 1.5 per cent, payable July 20.

Covington Light & Traction Company, quarterly of 1.5 per cent on preferred and 1.5 per cent on common, payable July 15 to stock of record June 30.

Demerara Electric Company; quarterly of one per cent, payable July 2 to stock of record June 22.

Edison Electric Illuminating Company of Boston; the regular quarterly dividend of three per cent, payable August 1 to stock of record July 15.

Electric Utilities Corporation; quarterly of 1.25 per cent on preferred and 0.5 per cent on common, payable July 15 to stock of record July 7.

Illinois Northern Utilities Company; quarterly of $1.50, payable August 1.

International Traction Company; semi-annual of two per cent on preferred, payable July 15 to stock of record July 7.

Memphis Street Railway Company; a quarterly preferred dividend of 1.5 per cent payable June 30.

Metropolitan West Side Elevated Company of Chicago; 1.75 per cent on preferred, payable June 30 to stock of record June 22.

Mexican Light & Power Company; a quarterly dividend of one per cent, payable July 15.

Mexican Telegraph Company; quar-

terly of 1.5 per cent, payable July 15 to stock of record June 30.

Michigan State Telephone Company; quarterly of 1.5 per cent on preferred and 1.5 on common, payable June 30 to stock of record June 14.

Montreal Telegraph Company; quarterly of two per cent, payable July 15 to stock of record June 30.

Montreal Tramways Company; a quarterly dividend of 2.5 per cent.

Mountain States Telephone & Telegraph Company; a quarterly dividend of 1.75 per cent, payable July 15 to stock of record June 30.

National Gas, Electric Light & Power Company; quarterly of one per cent on common and 1.5 per cent on preferred, payable July 1.

New England Power Company; semi-annual of three per cent on preferred, payable July 1 to stock of record June 24.

Ottawa Electric Railway Company; a quarterly dividend of three per cent, payable July 1.

Penn, Central Light & Power Company; a dividend of two per cent on preferred stock, payable July 1 to stockholders of record June 16.

Pennsylvania Lighting Company; quarterly of 1.25 per cent on preferred, payable July 15 to stock of record July 1.

Public Service Company of Northern Illinois; quarterly of $1.50 on preferred and $1 on common, payable August 1 to stock of record July 19.

South Side Elevated Railroad Company; 1.25 per cent, payable July 1 to stock of record June 24.

Southern California Edison Company; quarterly of $1.25 on preferred, payable July 15 to stock of record June 30.

United Gas & Electric Company; a semi-annual preferred dividend of 2.5 per cent, payable July 15.

United Railways & Electric Company of Baltimore; the regular dividend of 50 cents on the common stock payable July 1.

Reports of Earnings.

CITIES SERVICE COMPANY.

The Cities Service Company reports earnings for May, 1913, and the 12 months ended May 31, 1913 as follows:

	1913	1912
May gross	$ 111,142	$ 78,981
Net after expenses	104,112	73,500
Dividends	97,096	69,272
Surplus	7,015	4,228
Twelve months' gross	1,403,777	1,079,556
Net after expenses	1,334,921	1,007,640
Dividends	970,009	734,741
Surplus	364,912	272,898

Total accumulated surplus to May 31, 1913 is $835,031.

PACIFIC LIGHT & POWER.

Pacific Light & Power Corporation reports earnings for four months ended April 30, 1913, as follows:

	1913	1912
Gross earnings	$900,954	$790,900
Op. expenses and taxes	490,031	458,430
Net	410,922	332,470
Total fixed charges	159,731	165,092
Surplus	251,190	167,377

AUGUSTA-AIKEN RAILWAY & ELECTRIC.

The Augusta-Aiken Railway & Electric Corporation reports earnings for May, 1913, and the 12 months ended April 30, 1913, as follows:

May gross	$ 52,335	$ 51,968 Inc.
Total income	21,283	25,872 Dec.
Surp. after chgs	4,241	9,836 Dec.
12 months' gross	608,736	602,610 Inc.
Total income	296,076	303,124 Dec.
Surp. after chgs	98,412	122,416 Dec

FEDERAL LIGHT & TRACTION.

	1913	1912
May gross	$ 184,051	$164,534
Net	75,323	65,047
Five months' gross	1,000,597	875,445
Net	433,692	371,830

UNITED RAILWAYS OF ST. LOUIS.

	1913	1912
May gross	$1,120,757	$1,085,013
Net after taxes	342,694	331,490
Other income	7,396	7,019
Surplus after charges	127,610	113,003
Five months' gross	5,147,938	4,901,759
Net after taxes	1,490,567	1,494,510
Other income	36,308	22,510
Surplus after charges	412,601	389,286

AURORA, ELGIN & CHICAGO.

	1913	1912
May gross	$ 168,721	$ 159,261
Net after taxes	63,340	61,172
Surplus after charges	30,114	30,206
Eleven months' gross	1,770,936	1,664,061
Net after taxes	709,389	678,114
Surplus after charges	354,102	330,078

INTERBOROUGH RAPID TRANSIT.

	1913	1912
May gross	$ 2,857,075	$ 2,752,465
Net after taxes	1,518,333	1,469,480
Other income	57,261	44,525
Total income	1,576,094	1,514,005
Surplus after charges	647,304	594,969
Passengers carried	55,871,855	52,638,514
Eleven months' gross	$29,906,599	$28,739,248
Net after taxes	15,793,120	14,959,480
Other income	429,202	357,949
Total income	16,222,322	15,317,429
Surplus after charges	6,076,613	5,231,112
Passengers carried	588,805,345	558,653,673

LEHIGH VALLEY TRANSIT.

	1913	1912
May gross	$ 147,652	$ 123,325
Net	83,128	67,787
Surplus after charges	37,240	25,274
Twelve months' gross	1,643,722	1,423,762
Net	942,629	795,351
Surplus after charges	412,348	317,214

AMERICAN LIGHT & TRACTION.

	1913	1912
May gross	$ 333,731	$ 320,719
Net	323,002	310,027
Five months' gross	1,747,979	1,664,067
Net	1,694,577	1,611,656

BOSTON SUBWAY.

During May the gross earnings of the Middlesex & Boston Street Railway Company increased 5.56 per cent over a year ago. Earnings available for dividends gained 6.41 per cent. Below appears a comparison of the month and 11 months for two years, with the changes.

May:	1913	1912
Gross	$ 83,736	$ 79,326
Operating expenses	61,349	54,949
Net	$ 22,386	$ 24,376
Interest	13,651	13,926
Available for dividends	$ 8,734	$ 10,449
Eleven months:		
Gross	$839,132	$792,294
Operating expenses	629,142	580,512
Net	$209,990	$211,782
Interest	149,694	155,644
Available for dividends	$ 60,295	$ 56,138

THIRD AVENUE RAILWAY, NEW YORK.

The Third Avenue & Associated Companies reports consolidated statement of income for May and five months ended May 31, 1913, as follows:

May gross	$ 967,821
Net after taxes	362,017
Other income	4,969
Total income	366,986
Surplus after charges, sinking fund and depreciation	115,360
Five months' gross	4,114,624
Net after taxes	1,406,705
Other income	31,432
Total income	1,438,137
Interest, hire of equipment sh. pd.	564,383
Interest on adjustment mortgage income bonds	469,500
Depreciation	187,500
Net income applicable to stock	216,754

VIRGINIA RAILWAY AND POWER.

Virginia Railway & Power for May, 1913, and the months ended May 31, 1913, reports earnings as follows:

	1913	1912
May gross	$ 416,180	$ 381,382
Other income	8,369	5,470
Net after taxes	209,196	175,164
Surplus after charges	89,264	61,047
Eleven months' gross	4,445,144	4,171,573
Net after taxes	2,226,032	1,956,510
Other income	79,153	62,809
Surplus after charges	932,893	716,713

The increase in surplus after charges for the 11 months ended May 31, 1913, is 30 per cent over the surplus for the 11 months ended May 31, 1912. In each month $8,333 has been charged against operating expense for depreciation.

GREAT WESTERN POWER COMPANY.

In its report for May and the five months ended May, the Great Western Power Company shows an increase in surplus after interest deductions of nearly 100 per cent for the month and more than 50 per cent for the five months. The report of the company is as follows:

Month of May, 1913.	
Gross operating income	$228,981.53
Operating expenses and taxes	71,917.34
Net operating income	$157,064.19
Other income	14,514.73
Net income from all sources	$17,578.92
Bond interest	95,108.34
Surplus for May, 1913	$76,470.58
Surplus for May, 1912	38,915.88
Increase of 1913 over 1912	$37,554.70
Five Months, Ending May 31, 1913.	
Gross operating income	$1,091,086.25
Operating expenses and taxes	360,048.47
Net operating income	$731,037.78
Other income	69,799.59
Net income from all sources	$800,837.37
Bond interest	473,243.05
Surplus, five months ending May 31, 1913	$ 327,594.32
Surplus, five months ending May 31, 1912	214,593.77
Increase of 1913 over 1913	$113,000.55

CLOSING BID PRICES FOR ELECTRICAL SECURITIES ON THE LEADING EXCHANGES AS COMPARED WITH THE PREVIOUS WEEK.

	June 30.	June 23
American Tel. & Tel. (New York)	129	127½
Commonwealth Edison (Chicago)	128	128
Edison Electric Illuminating (Boston)	270	266
Electric Storage Battery common (Philadelphia)	46	46
Electric Storage Battery preferred (Philadelphia)	46	46
General Electric (New York)	135½	134½
Kings County Electric (New York)	129	129
Manhattan Transit (New York)	1⅜	1⅜
Massachusetts Electric common (Boston)	13	12
Massachusetts Electric preferred stamped (Boston)	67	67½
National Carbon common (Chicago)	*113	113
National Carbon preferred (Chicago)	*111	111
New England Telephone (Boston)	138½	137
Philadelphia Electric (Philadelphia)	21⅝	21⅝
Postal Telegraph and Cables common (New York)	76¾	76½
Postal Telegraph and Cables preferred (New York)	66	67
Western Union (New York)	60¼	60¼
Westinghouse common (New York)	59	56¾
Westinghouse preferred (New York)	106	105⅞

*Last price quoted.

PERSONAL MENTION.

GEORGE W. LAMKE, assistant professor of electrical engineering at Washington University, has resigned to take up active practice.

HARRY G. HAKE, of the University of Illinois, has been appointed assistant professor of electrical engineering at Washington University.

CHESTER H. HARDY, instructor in electrical engineering at Washington University, will engage in business and has resigned his post with the University.

ALEXANDER GRAHAM BELL has been honored by Dartmouth College at its 144th commencement exercises by the granting of the degree of Doctor of Laws.

GENERAL MORRIS SCHAFF, a member of the Board of Gas and Electric Light Commissioners of Massachusetts, has been honored with the degree of Doctor of Laws by Williams College.

F. L. BROWN, superintendent of the Long Beach, Cal., branch of the Pacific Telephone & Telegraph Company, has resigned, to take effect July 1. Mr. Brown will enter commercial life in Los Angeles.

ARTHUR E. KENNELLY, professor of electrical engineering in Harvard University and vice-president of the Committee on Organization of the 1915 International Electrical Congress, sailed for Europe on June 24.

J. P. WHITEHEAD, hitherto professor of applied electricity at Johns Hopkins University, has been appointed to the chair of electrical engineering of the faculty of the new School of Technology of Johns Hopkins.

W. H. WILLIAMS, formerly, in the Pittsburgh office of the Electric Controller & Manufacturing Company, has been transferred to the Chicago office of the same company to assume the duties of district manager of the Chicago territory.

G. A. KNOCHE, of the general sales organization of the Western Electric Company, has been appointed manager of the printing and stationary division of the general purchasing department at New York. Mr. Knoche has had a long experience in the electrical business.

W. J. CANADA, engineer for the Rocky Mountain Fire Inspection Bureau, has been selected by the Bureau of Standards, Washington, D. C., to carry on the investigation about to be instituted by that Bureau on the protection to life in connection with the operation of high-tension lines.

F. FAIRMAN, formerly head of the engineering inspection department of the Western Electric Company, has been assigned to sales work in China, and left for his new post on June 12. Mr. Fairman goes to increase the company's representation in the Far East, where it has already secured several large contracts.

S. W. STRATTON, director of the National Bureau of Standards, Washington, D. C., made an address before the Chicago Association of Commerce on July 18, giving a short account of the routine and systemization enforced by the Government department in the standardization of measurements and materials.

C. B. GOODELL, after being manager of the Long Beach branch of the Western Union Telegraph Company for several years, and having been in the employ of that company for the past 30 years, has been retired on a pension. He will be succeeded by S. S. HAWKINS, for the past year superintendent of the field department of the Southern Division.

B. S. JOSSELYN, who retired from the presidency of the Portland Railway, Light & Power Company on July 1, after five years' service in that position, was presented by the employees and officers of the company with 11 pieces of solid silver, comprising a Paul Revere set, costing $1,000. Mr. Josselyn had won the affection and loyalty of everyone in the company, and the gift was the result of a concerted action upon the part of every member of the organization.

D. C. WYNNE has resigned his position as expert electrical engineer in the office of the State Architect, Albany, N. Y., which position he has held for the past 13 years, and is now devoting himself to private consulting engineering practice. Mr. Wynne has opened an office at 86 State Street, Albany, and will undertake the work of preparing plans and specifications for electrical and mechanical requirements of all kinds, and make investigations and reports relative to engineering matters.

ROBERT ABBOTT, who, since his graduation from Yale, has been the New York City representative of the Bryant Electric Company, Bridgeport, Conn., won the golf championship of the State of Connecticut on the links of the New Haven Country Club last Saturday, defeating H. T. TOPPING, of the Greenwick Country Club, four up and three to play. Mr. Abbott represented the Brooklawn Country Club, Bridgeport, Conn. He has long been known as an excellent player of the game, and is one of the longest drivers in the country. While at Yale he was intercollegiate champion.

W. D'A. RYAN, illuminating engineer of the General Electric Company, Schenectady, N. Y., and in charge of illumination for the Panama-Pacific International Exposition to be held in San Francisco in 1915, was the speaker at the luncheon of the Jovian Order on June 26, at the Fort Pitt Hotel, Pittsburgh. Mr. Ryan told of the plans of the electrical engineers in charge to make the exposition one of the greatest electrical demonstrations in the history of the world. On the same date he addressed the salesmen of the Union Electric Company in the offices of the concern in the Terminal Warehouses, Southside. The salesmen were holding a three-day conference, and Mr. Ryan was secured to be present at one of these sessions. W. C. JONES, manager of sales for the Union Company, was president of the gathering.

JOHN F. WALLACE has been selected as the expert advisor of the Chicago City Council Committee on Railway Terminals. Mr. Wallace is president of the engineering firm of Westinghouse, Church, Kerr & Company, 37 Wall Street, New York. For many years he was connected with the Illinois Central Railway and later was engineer for the Panama Canal. He was expert for the Pennsylvania Railroad in the condemnation suit of the Sanitary District of Chicago for a strip of land owned by the railroad which was desired to widen the south branch of the Chicago River. Mr. Wallace is required to make a report of the entire terminal situation in Chicago, both freight and passenger, with sufficient data and information supporting his recommendations that his report may be of material assistance in formulating a general policy.

JOHN R. HARMON, for the past five years connected with various departments of the Sanitary District of Chicago, has resigned to become commercial engineer of the La Crosse Gas & Electric Company, La Crosse, Wis. Mr. Harmon is a central-station man of great ability and wide experience. He is of the younger generation of men who understand the right way of doing things in the commercial department, and he brings to the company a strong personality and great capabilities. Mr. Harmon has been prominently identified with many civic and engineering enterprises in Chicago, and served on the Board of Managers and as chairman of the Speakers' and Entertainment Committees of the Electric Club for several years. A host of friends and acquaintances will learn of his departure to his new field with a great deal of personal regret, but with sincere wishes that he will meet with the greatest success.

PROPOSALS.

TRANSFORMERS, ETC.—Sealed proposals will be received on July 10 by W. J. Springborn, Director of Public Service, Cleveland, O., for electric-driven telphers and transformers, etc., for the municipal electric light plant, Cleveland.

INSULATORS.—Sealed proposals will be received at the office of the United States Reclamation Service, Los Angeles, Cal., until July 7, for furnishing insulators for the Minidoka project, Idaho. For further information address O. H. Ensign, consulting engineer.

MOTOR-DRIVEN TOOLS.—Sealed proposals will be received by the Bureau of Supplies and Accounts, Navy Department, Washington, D. C., until July 22 for furnishing various motor-driven tools for delivery at the Navy Yard, Mare Island, Cal., as per Schedule 5,597.

CONDUIT AND WIRING SYSTEM.—Sealed proposals will be received at the office of the Supervising Architect, Washington, D. C., until July 28 for a conduit and wiring system in the Marine Hospital, Chicago, Ill., in accordance with drawings and specifications, copies of which may be obtained from the Washington office.

ELECTRIC ELEVATOR.—Sealed proposals will be received at the office of the Supervising Architect, Washington, D. C., until July 22, for the installation complete of an electric passenger elevator in the post office at Del Rio, Tex., in accordance with drawings and specifications, copies of which may be obtained from the Supervising Architect.

STEEL CABLE, ETC.—Sealed proposals will be received at the office of the General Purchasing Officer, Isthmian Canal Commission, Washington, D. C., until July 17, for furnishing

steel cable, sheet copper, motor-driven lathe, etc., as per Canal Circular 783. Blanks may be obtained from the assistant purchasing officers in any of the large cities.

MISCELLANEOUS ELECTRICAL EQUIPMENT.—Sealed proposals will be received by the Bureau of Supplies and Accounts, Navy Department, Washington, D. C., until July 8, for furnishing 25 arc-light brackets, 1,700 feet of two-inch galvanized conduit, 42 combination automatic cutouts and hangers for series arc lamps, 30 inclosed series arc lamps, 9 iron electric-light poles, all to be delivered at the Navy Yard, Brooklyn, N. Y., as per Schedule 5,591; and until July 15 for furnishing one Keepsel magnetizing apparatus, miscellaneous electrodynamometers, voltmeters, etc., 8 Wolff standard resistances, etc., and one universal shunt, all to be delivered at the Navy Yard, Annapolis, Mo., as per Schedule 5,599.

DATES AHEAD.

Electrical Contractors' Association of the State of Missouri. Annual meeting, St. Louis, Mo., July 12.

Ohio Electric Light Association. Annual convention, Cedar Point, O., July 15-18.

National Electrical Contractors' Association. Annual meeting, Chattanooga, Tenn., July 16-19.

California State Association of Electrical Contractors. Fourth annual convention, Santa Barbara, Cal., August 13-16.

Michigan Section, National Electric Light Association. Annual convention, Ottawa Beach, Mich., August 18-21.

International Association of Municipal Electricians. Annual meeting, Watertown, N. Y., August 19-22.

Old-Time Telegraphers and Historical Association and Society of the United States Military Telegraph Corps. Annual reunion, Detroit, Mich., August 26-28.

Association of Edison Illuminating Companies. Annual convention, Cooperstown, N. Y., September 8-11.

American Electrochemical Society. Annual meeting, Denver, Colo., September 9-11.

Northwest Electric Light and Power Association. Annual convention, Seattle, Wash., September 10-12.

Pennsylvania Section, National Electric Light Association. Annual convention, Delaware Water Gap, Pa., September 16-18.

New England Section of the National Electric Light Association. Annual convention, Hotel Vermont, Burlington, Vt., September 17-19.

Illuminating Engineering Society. Annual convention, Pittsburgh, Pa., September 22-26.

Electrical Exposition and Motor Show of 1913. New Grand Central Palace, New York, N. Y., October 15-25.

With the Electrical Manufacturers

Western Lamp & Brass Works, 17-21 East Twenty-third Street, Chicago, is making special prices on a dozen different types of ornamental electric lamps and domes. A circular illustrating and describing these lamps, with bargain prices, will be sent to those interested, upon request.

Lockwood, Greene & Company, architects and engineers for industrial plants, 60 Federal Street, Boston, Mass., have removed their New York offices from 320 Fifth Avenue to the Architects' Building, 101 Park Avenue. The New York representatives of this concern are Frank A. Wing and John M. Toucey.

Delta-Star Electric Company, 617 West Jackson Boulevard, Chicago, Ill., has issued a 32-page technical bulletin entitled "Outdoor Substations." This gives detailed descriptions of a number of high-tension outdoor substations installed at low cost. Copies of this publication will be sent on request to the company.

Morris Iron Company, Frederick, Md., has opened a New York City office at 50 Church Street in charge of J. W. Bache. Through this office an order has just been secured from the Public Service Electric Company of New Jersey, for 177 combination trolley and arc-light posts for the use of the City of Newark, N. J.

Oskar Weber, 25 Paris Street, Berlin West, Germany, announces that he has prepared a new catalog, No. 200, describing and illustrating in detail his lighting specialties, especially wiring devices for metal-filament lamps of every description. This catalog is well printed and carefully indexed, and is prepared in five languages, German, English, French, Portugese and Spanish.

H. W. Johns-Manville Co., Madison Avenue and Forty-first Street, New York City, is sending out to the trade an attractive folder calling attention to the advantages of J.-M. Mobilite electric lamps for automobiles and motor boats. The automobile sets usually comprise four lamps which, it is said, can be operated intermittently for 60 to 120 hours on a set of six No. 6 dry cells.

Triumph Electric Company, Cincinnati, Ohio, has issued bulletin No. 1020 devoted to three-wire generators. In these machines the neutral connection is provided by means of a three-phase balancing transformer separate from the machine itself. The theory and construction of this system is explained in detail and the parts of the machines are described with the aid of numerous illustrations.

Stromberg-Carlson Telephone Manufacturing Company, Rochester, N. Y., has prepared for distribution two pamphlets, of which No. 41 deals with the latest types of standard central-energy telephones. Pamphlet No. 42 deals with standard local-battery telephones; among these are included some important improvements in the No. 896 type of compact wall telephones, also a new harmonic party-line telephone. Combination telephones are also listed.

Condensite Company of America, Glen Ridge, N. J., has issued a booklet entitled Holowaxes. This trade name has been given to a new series of synthetic waxes and oil. These compounds are chlorine substitution products having unique properties of non-inflammability, high boiling points and a wide range of melting points. Halowax oil may be used for oil insulation of electrical apparatus. The Halowaxes are solids and are of service, among other things, for protecting cathodes in electroplating, impregnating electrical coils, for sealing or imbedding coils, for fireproofing and for various laboratory uses in place of oil or paraffin baths.

National Metal & Rubber Company, 30 and 31 India Wharf, Boston, Mass., is in the market to buy old battery lead plates, battery sediment and rubber jars. If anyone has a storage-battery plant out of working condition and wishes to dispose of it, the company will be glad to know the number of cells, the size of the plates, and also if any machinery is connected with the plant, giving the particulars of the same. The company states that its terms are spot cash and that representatives in all vicinities will make commissions and prompt reports.

Dossert & Company, 242 West Forty-first Street, New York City, has issued a new catalog of its solderless connectors. This is a 62-page publication commemorating the tenth year of the commercial use of these connectors for both solid and stranded wires and cables. The catalog gives useful information on the construction of copper cables and detailed descriptions of the various types of Dossert connectors, which are illustrated with many half-tones and dimension diagrams. Full data are given of each type of connector manufactured.

Monitor Controller Company, 111 South Gay Street, Baltimore, Md., has issued a 16-page bulletin on the Monitor system of machine control. The advantages of this simple and reliable method of control are set forth and various types of automatic controllers are described and illustrated. A number of these involve speed control, as well as automatic starting and stopping of the motor. For reversing planers an intricate but very satisfactory automatic control equipment has been

provided. The bulletin also describes details of the controller construction, of the automatic switches, etc.

Electric Controller & Manufacturing Company, Cleveland, O., has prepared a unique booklet entitled "More Chips." This describes and illustrates in great detail the automatic control of machine tools, and deals with the system for control of motor-driven machinery which the manufacturers state is the acme of convenience and simplicity. In numerous cases increases in output of from 10 per cent to 40 per cent have been made; through its use "more chips" are made. Millwrights, power engineers, contractors and everyone interested in the automatic control of machine tools of every description should secure a copy of this study without delay.

Smith & Hemenway Company, 150-152 Chambers Street, New York City, manufacturer of the largest line of hand tools made in the United States, and owner of the famous trade-mark, the genuine "Red Devil," informs us that instead of carrying stock in two places it has arranged to carry at the factory of the Irvington Manufacturing Company, 130 Coit Street, Irvington, N. J., a complete stock after July 10 and all shipments will be made from Irvington after that date. This is a movement for facilitating shipment to customers and making more prompt delivery. The company has also largely increased the facilities of its factory and stock room to take care of additional stock and of increased business.

Fairbanks, Morse & Company, Chicago, Ill., has issued bulletin No. 35 which is in the form of a unique catechism on alternating-current machinery. This publication, like the similar one published by the company two years ago on direct-current apparatus, gives a group of the most frequently recurring questions on alternating currents, alternators and alternating-current motors with simple and easily understood answers thereto. Particular attention is given to induction, repulsion and synchronous motors. A glossary of unavoidable technical terms is also given. The bulletin is well illustrated with numerous views of Fairbanks-Morse generators and motors and typical installations of the same.

The firm of **Brill & Gardner,** engineers, Marquette Building, Chicago, has been dissolved by the retirement of George M. Brill, its founder. Mr. Brill is taking a much needed rest from active engineering work and contemplates spending considerable time in travel and study. The business of the firm in the mechanical, electrical and industrial engineering of manufacturing and power plants, business buildings, warehouses and the like, is being continued in the same offices under the firm name **Gardner & Lindberg.** Mr. Gardner was mechanical engineer for Swift & Company for 20 years and joined Mr. Brill three years ago, at which time the firm name became Brill & Gardner. Mr. Lindberg has been associated with Mr. Brill for 12 years and was admitted to the firm two years ago.

Lidgerwood Manufacturing Company, 96 Liberty Street, New York, N. Y., has issued bulletin No. 12. This is a large-sized publication with an attractive embossed cover and is devoted to Lidgerwood electric hoists. It shows all of the numerous standard hoists adapted for a wide range of duties and uses, and also some interesting examples of hoists designed and built by the company for special uses. The bulletin is devoted only to the hoists themselves which are well described, illustrated and cataloged. They are provided with every variety of control from the simple drum type controller to the most elaborate automatic control system. Some are arranged so that the operator has merely to touch a push-button, the controller starting and accelerating, retarding and stopping the hoist automatically and after a definite interval returning it to starting point. Series direct-current and wound-rotor induction motors are used.

Record of Electrical Patents.

Issued by the United States Patent Office, June 24, 1913.

1,065,344. Toy Construction. J. L. Cowen, New York, N. Y. A motor-driven and electrically controlled car.

1,065,361. Electrode Box. H. B. Hartman, Philadelphia, Pa., assignor of one-half to G. A. Dunning. Comprises a stack of separated electrode plates with aperatures to produce a zigzag channel through the stack.

1,065,362. Flow-Responsive Circuit-Controller. H. B. Hartman, assignor of one-half to G. A. Dunning. A switch mechanism is actuated by a piston in the cylinder.

1,065,363. Reversing-Switch Mechanism. H. B. Hartman, assignor of one-half to G. A. Dunning. Reciprocation of a piston in a compressed-air cylinder actuates the switch.

1,065,370. Carbureter. F. Johnston, Los Angeles, and O. E. Kellum, Long-beach, Cal. Contains an electric heating element controlled by a thermostat.

1,065,371. Support for Electric Lights. J. H. Kellogg, assignor to Sanitarium Equipment Co., Battle Creek, Mich. Is adjustable in several directions.

1,065,380. Electrode Contact-Clamp. J. G. Marshall, assignor to Union Carbide Co., Niagara Falls, N. Y. A compressed-air motor applies the jaws to the electrode.

1,065,388. Panelboard Support for Outlet Boxes. W. F. O'Neill, Wilkinsburg, Pa. Circular sockets are secured to the corners of the board and engage eccentrics on the box corners for adjusting the box.

1,065,423. Electric-Lamp Bracket. N. T. Zeigler, Reno, Nev. A wire clamp with hook at one end and a socket-engaging loop at the other.

1,065,424. Wheel-Bearing. W. H. Arnold, Stockton, Cal. A special lubricated hub for the trolley wheel.

1,065,426. Electric Heater. H. W. Beers, Guadalajara, Mexico, assignor of one-half to R. Epperson. The heating element is imbedded in the top of a block with an open side.

1,065,434. Cigar-Lighter. C. S. Drake, Milwaukee, Wis. Provides electric ignition for the wick.

1,065,465. Electric-Heater. J. Nathan, Coutolenc, Cal. Includes a special electrode holder.

1,065,478. Repeating-Transmitter for Fire-Alarm Telegraph Systems. N. H. Suren, assignor to Gamewell Fire-Alarm Telegraph Co., New York, N. Y. Has a motor-driven operating member for the circuit-operating device.

1,065,492. Joint for Electrical Conduits. C. W. Abbott, assignor to National Metal Molding Co., Pittsburgh, Pa. A fitting box has an extension joining the end of the metal molding, a screw fitting into the slotted end of the latter.

1,065,493. Circuit-Extension Box. C. W. Abbott, assignor to National Metal Molding Co. A terminal box secured to a concealed conduit has joined to it metal molding for surface wiring.

1,065,513. Automatic Electric Display Sign. J. C. Eubank, Kansas City, Mo. Consists of several groups of lamps arranged in close rows, and a motor-driven contact mechanism for lighting selected lamps so as to display any desired character.

1,065,532. Dynamo-Electric Machine. E. R. Knight, assignor to Allis-Chalmers Co. The short-circuiting rings of an induction-motor rotor have slots in alinement with those of the core.

1,065,550. Electric Switch. E. H. Rieken, Chicago, Ill. An alternating-current motor switch with starting, running and off positions.

1,065,567. Circuit-Interrupter for Electric Ignition Systems. R. Wagner, assignor to firm of Robert Bosch, Stuttgart, Germany. Has mechanism for periodically separating the contact terminals.

1,065,570. Telephone-Receiver Support. C. D. Wightman, Glenwood Springs, Colo. Consists of a hinged tube attached to the rim of the transmitter casing.

1,065,576. Combination Apparatus for Synchronizing Motion and Sound Reproductions. E. H. Amet, Redondo Beach, Cal. Electropneumatic mechanism for connecting a moving-picture machine and a phonograph.

1,065,580. Vaporizer. T. Beucus, Cedar Springs, Mich. An oil vaporizer with an electric heating unit in one or more of the oil chambers.

1,065,600. Switchboard-Plug Cleaner. L. J. Euchenhofer and W. C. B. Anderson, Dayton, O. Includes a pair of belt-driven cloth buffing wheels.

1,065,605. Process of Removing Sulphur and Phosphorus from Iron and Similar Metals. A. E. Greene, assignor to American Electric Smelting & Engineering Co., St. Louis. An electric furnace process.

1,065,628. Signal-Sending Device. H. O. Rugh, Sandwich, Ill., assignor to Hall Switch & Signal Co. A station selector for telephone train-dispatching system.

1,065,640. Fuel-Vaporizing Device.

J. A. Thompson, Oskaloosa, Iowa. A carbureter with a heating coil and means for varying the resistance in series with the coil.

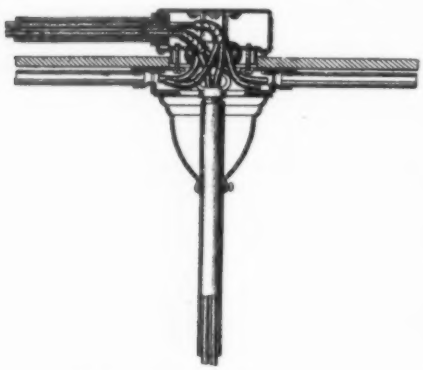
1,065,649. Pneumatic Governor. B. S. Aikman, assignor to National Brake & Electric Co., Milwaukee, Wis. The piston of an air cylinder controls an electric switch.

1,065,653. Municipal Lighting and Police Signaling System. J. P. Barrett, Chicago, Ill. Combined with a generating station and a substation for the lighting system is a special set of signal lamps controlled from a police station.

1,065,656. Automatic Means for Steering and Balancing Aerial Machines. P. Benni, Lublin, Russia. Provides pendulum-controlled electromagnetic means for adjusting the rudder.

1,065,657. Electric Controller. A. E. Berdon, assignor to Esterline Co., La Fayette, Ind. Includes a permanent magnet, movable pressure and current coils and an electromagnetic switch mechanism.

1,065,669. Street Hood for Electric Lamps. G. T. Dunklin, assignor to George Cutter Co., South Bend, Ind. Consists of a canopy, an insulating



1,065,493.—Circuit Extension Box.

block, a lamp socket and reflector and means to keep the socket and reflector from dropping in case the insulating block is broken.

1,065,672. Auxiliary Visual Indicator. H. R. Elliott, assignor to Auto Speed Signal Co., Los Angeles, Cal. A centrifugal governor mechanism closes a circuit switch.

1,065,683. Annunciator. H. J. Heeney, assignor to Holtzer-Cabot Electric Co., Brookline, Mass. A spring moves the target to vertical display position and an electromagnet holds it in unexposed position.

1,065,692. Trolley Wheel. J. Kress, New Rochelle, N. Y. The wheel and harp can oscillate through a small angle in either direction.

1,065,704. Film-Coated Metallic Article and Method of Making the Same. R. D. Mershon, New York, N. Y. An aluminum electrode having on its surface a dense and durable film of aluminum possessing high dielectric strength and specific resistance.

1,065,722. Train Control. F. M. Raymond, Saugatuck, Conn. Comprises a main line, a branch line of different potential adjoining it and electromagnetic means for diverting the car contactor from the main to the branch line.

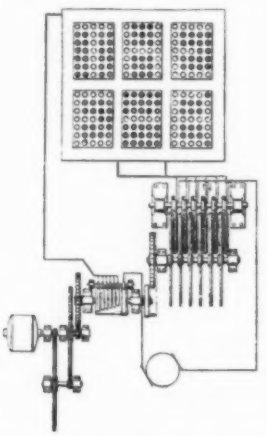
1,065,737. Insulator and Support. A. J. Slonecker, Trenton, Mo. A conical insulator with a spiral line-wire-receiving grove, mounted on a rotatable sleeve so as to prevent longitudinal movement of the insulator upon the sleeve but to permit tightening or slackening of the line wire.

1,065,756. Cabinet-Stand for Electric Picture-Projection Apparatus. F. T. Wilson, Stillwater, Minn. Electric controlling mechanism is mounted on the inside of one of the doors.

1,065,760. Means for Switching Booster-Transformers. W. Zederbohm, assignor to Siemens-Schuckert-Werke, G. M. B. H., Berlin, Germany. Provides a set of switches with resistance between the first two contact pieces of each.

1,065,771. Trolley. M. A. Born, Oconomowoc, Wis. Has a restoring wheel on each side of the trolley wheel.

1,065,798. Shade-Holder. G. W. Goodridge, assignor to Bryant Electric Co., Bridgeport, Conn. Comprises a body with depending skirt and inturned flange at the lower edge of the latter and spring catches rigidly secured with-



1,065,513.—Automatic Display Sign.

in the skirt and supported at the lower edges of the flange.

1,065,802. Fire and Waterproof Insulation. H. Hammesfahr, Brooklyn, N. Y. The method of applying insulation to a wire consists in drawing it through a soap mixture containing blown glass crushed to a matted flocculent condition.

1,065,804. Gong-Actuating Mechanism for Electric Cars. R. A. Heffley, Denver, Colo., assignor of one-half to A. T. Hart. A push pin in the handle of the controller closes the gong circuit.

1,065,805. Telephone Attachment. S. J. Heimbuecher, Jr., Pittsburgh, Pa. A lazy-tong extension for holding the receiver to the user's ear.

1,065,818. Trolley Pole. A. Levesque, New Bedford, Mass. A special harp construction.

1,065,851. Trolley-Replacer. G. A. Spaeth, Columbus, O., assignor of one-third to D. Schaaf. A relatively fixed replacer roller is carried by the trolley pole adjacent to the outer position of the trolley wheel.

1,065,861. Burglar Alarm. G. A. Brewster, New York, N. Y. Movement of a pendulum out of its normal position closes the alarm circuit.

1,065,862. Electrical Igniting Device for Explosive Engines. A. R. Bullock, assignor to Igniter Appliance Co., Cleveland, O. A spark plug with an electromagnet and armature.

Patents That Have Expired.

Following is a list of electrical patents (issued by the United States Patent Office) that expired June 30, 1913.

562,796. Electric Railway. H. Brandenburg, Chicago, Ill.

562,806. Conduit for Electrical Conductors. J. F. Cummings, Detroit, Mich.

562,850. Electric Gas-Lighting Apparatus. F. O. Plummer, Worcester, Mass.

562,864. Dynamo-Electric Machine. N. W. Storer, Wilkinsburg, Pa.

562,868. Dynamo-Electric Machine. C. C. Warren and H. B. Warren, Chicago, Ill.

562,890. Electric Railway. B. Ford, Johnstown, Pa.

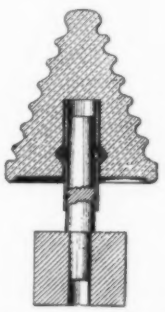
562,891. Electric Hand Lighting Gas-Burner. G. J. Gailbraith, Boston, Mass.

562,894. Electric Railway. W. E. Hanshue, Kalamazoo, Mich.

562,906. Signaling Apparatus for Telephone Lines. F. R. McBerty, Downer's Grove, Ill.

562,924. System of Electrical Distribution. G. J. Scott, Philadelphia, Pa.

562,925. Automatic Speed-Controller for Electric Cars. H. A. Seymour, Washington, D. C.



1,065,737.—Line-Tightening Insulator.

562,929. Electric Signal. C. H. Sherwood, Utica, N. Y.

562,937. Electric Hand Lighting Gas-Burner. H. C. Thomson, Boston, Mass.

562,980. Cutout for Electric Circuits. G. W. Scovil and E. F. Gooding, Elgin, Ill.

563,016. Electrode for Galvanic Belts. E. S. Collicott, London, England.

563,025. Electric Signaling Apparatus. M. Du Perow, Washington, D. C.

563,032. Electric Heater. W. B. Hadaway, Jr., New York, N. Y.

563,033. Automatic Alarm for Postal Chutes. T. F. Hagerty, Woburn, Mass.

563,052. Electric Program Clock. D. Ogden, Columbus, Ind.

563,073. Apparatus for Telephone Switchboards. C. E. Scribner, Chicago, Ill.

563,084. Telephone System. J. G. Smith, New York, N. Y.

563,094 Electric Railway. J. Tatham, Philadelphia, Pa.

563,127. Galvanic Battery. E. S. Boynton, Brooklyn, N. Y.

563,148. Telegraph Alphabet. S. V. Essick, Yonkers, N. Y.

563,149. Telegraphy. S. V. Essick.

563,244. Electric Railway Trolley System. W. C. Keithly, San Francisco, Cal.

563,245. Telephone Switchboard System. C. E. Scribner, Chicago, Ill.

Electric Vehicle Section

THE CENTRAL STATION'S GREATEST OPPORTUNITY—THE ELECTRIC VEHICLE.[1]

By E. E. Witherby.

Unquestionably, the greatest business opportunity is where we get the greatest volume of business. You may have a flat-iron in every house in your territory, a toaster, perhaps a vacuum cleaner, and an occasional washing machine, and some one or two of the many other useful domestic appliances in practically every home, and you smile complacently and look satisfied.

You do not realize as you go from home to office or returning that you pass the various horse wagons, and there are thousands of them, or the gasoline truck once in a while, that the biggest piece of real business in every man's community is the transportation of persons and merchandise and that at least 50 per cent of all the tonnage that you see every day can be hauled cheaper by electric vehicles than it can be done by horses or gasoline machines. Gentlemen, it is the greatest piece of business in the world today.

The pleasure car or the electric truck salesman has a hard up-hill job to convince the man or woman who wants, for personal use, a simple and elegant vehicle to buy an electric, or to influence the merchant or warehouseman in the purchase of electric commercial vehicles, when the officers and superintendents of the electric company are all driving around in gas cars and are using horses and gas trucks for the work of the central stations. And, let me emphasize the fact that this is not an idle statement, on the other hand, is the usual condition, I am sorry to say. Now I am not taking every central-station man to task on this—there are a few who realize the opportunity and are honestly trying to help the electric vehicle and in this way help themselves for a big record of increase in business and their stockholders to dividends, but the small percentage of the whole who are helping is what hurts us all,—I honestly believe less than ten per cent of all central station men. Now is it not time to change your methods and get in line?

1 Paper read before the National Electric Light Association, Chicago, June 2-6, 1913.

Quoting from Mr. Jones' paper read at the Illinois State meeting, "that if half of the horses in Chicago were replaced by electric vehicles, this estimated load amounts to 94,000,000 kilowatt-hours per annum, to take care of which no additional investment in station equipment would be required, and this off-peak output would increase the general load-factor 13.2 per cent.

High class engineers have for years worked to produce apparatus that will give great economies. This is more true in the electric field than any other class of engineering and they have accomplished something, but the greatest economy has been brought about not so much by change in design as by larger units and better load-factor. In the old days, electric stations operated from dusk in the afternoon until one A. M., or perhaps until daylight, with a load-factor of five to six per cent. A little later we ran our plants 24 hours a day, and with a combined railroad and lighting plant we had a load-factor of perhaps 25 per cent and sold current at 20 cents a kilowatt-hour. Now the universal power in small establishments is the electric motor. Domestic appliances are everywhere. Our generating units have gone from 37½ and 50 kilowatts to 15,000 or 20,000 kilowatts and now we are soon to see one of 30,000 kilowatts installed in the city of Chicago. Load-factor is being improved constantly. We are all looking for the ideal 100 per cent and our chances are good,—but how? Most of our power motors are cutting out about five or six P. M. and starting at seven or eight A. M. Our regular residence and commercial load is off the lines by midnight (except in New York), but we cannot turn night into day and we cannot expect to see the time when all factories will work nights as well as days, for men will not do it. What we must get is a load from ten, eleven or twelve o'clock at night until seven in the morning, and the electric vehicle is the one thing to do it and give the load necessary to flatten out the load curve, and the nearer we get to 100 per cent the lower our cost and the greater efficiency, which means, as stated before, dividends.

You have been thinking so far that I have not proved my case—but I will. The electric-vehicle salesman has convinced thousands of ladies that the electric pleasure car is what they want—the central-station man did not do it, and thousands of these vehicles are in use today and are here to stay. The electric-truck salesman has convinced hundreds of up-to-date merchants and manufacturing companies. The result is that thousands of electric trucks are in daily use and they work every work day. These salesmen have increased the revenue of electric light and power companies thousands of dollars annually. Now what co-operation and help do we get from the average central-station man? I say, emphatically, not a particle. We thank our lucky stars there are some exceptions and the exceptions are the ones that are now getting the greatest return for their help and assistance when we needed it most.

To prove up again, look at the illustrations of some of the public garages in Chicago, as shown in this paper:

The Elite Garage has installed a 25-kilowatt and a 75-kilowatt motor-generator set to take care of 100 to 150 electric cars; the Terminal Garage a 25-kilowatt and two 75-kilowatt motor-generator sets and two 50-ampere rectifiers to take care of 100 to 180 cars; the Lake View Garage a 50-kilowatt motor-generator set and two 50-ampere rectifiers, to take care of 50 electric cars; the private garage of Carson, Pirie, Scott & Company, a 25-horsepower motor-generator set, and one of Marshall Field & Company, a 75-kilowatt motor-generator set. Marshall Field & Company will have in all their garages over 1,500-kilowatts installed. These are just a few of the newer installations now in Chicago.

Quoting further from Mr. Jones' paper: "In Fig. 8 there is shown a daily load curve of a prosperous modern electric garage taking care of from 60 to 75 pleasure vehicles. This garage is being operated by central-station current and under a 'Limited Hour' contract which permits them to do charging at any time of the day during the summer months, but during the winter months they are not permitted to do charging during time of 'peak hours' of the central station, namely, between the hours of four and eight P. M."

A garage for commercial trucks

would have a somewhat different curve, as a heavy load would be put on at about eight o'clock, as shown in the accompanying illustration, and continue more or less steadily throughout the night.

I will admit that you are not all operating plants in cities like Chicago, but you can all have your proportions if you will work for it, and, as an example of the operation take one of our department stores in Chicago, which has in use and on order 139 electric commercial cars, has installed and on order 1,500-kilowatts capacity of charging apparatus. Another illustration shows the amount of current furnished this company for charging purposes alone and please note the shape of the curve. Is it not a surprise to you to realize that one consumer pays for 39,000-kilowatt-hours in one month and, gentlemen, this same department store has a number of electric vehicles on order now and is preparing to add still more.

Now another fact: In the city of Chicago there were in use

Nov., 1910, 80 electric commercial trucks.

Nov., 1911, 150 electric commercial trucks.

Apr., 1912, 263 electric commercial trucks.

Nov., 1912, 265 electric commercial trucks.

Jan., 1913, 523 electric commercial trucks.

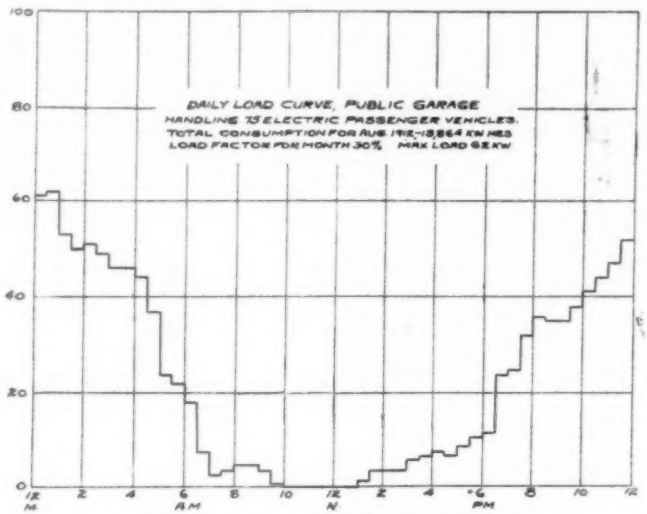
May, 1913, 647 electric commercial trucks.

And, as the saying is, "that's going some," and the live combinations in this city are hoping for a thousand by December 31, 1913. While some of us are working for trucks all the time, some others are just as hard at work on pleasure cars. While the pleasure car is exceedingly popular with the ladies, the business man is putting it to a broader use to meet his requirements around the city, as the electric is the only real practical car for city use.

Some ten years ago, I was the owner of a couple of electric cars—a runabout and a surrey—and being a central-station man supposed I should know all about them because they were electric. I had a lot to learn and it was expensive. Current for charging cost 15 cents per kilowatt-hour at first, and later 12 cents, and today, in most places, you pay 10 cents, if you keep your car at home. But in Chicago, in public garages, you pay from two to six cents, depending on quantity.

A great many central-station men with small plants look upon the electric vehicle as something that should be shunned and not encouraged.

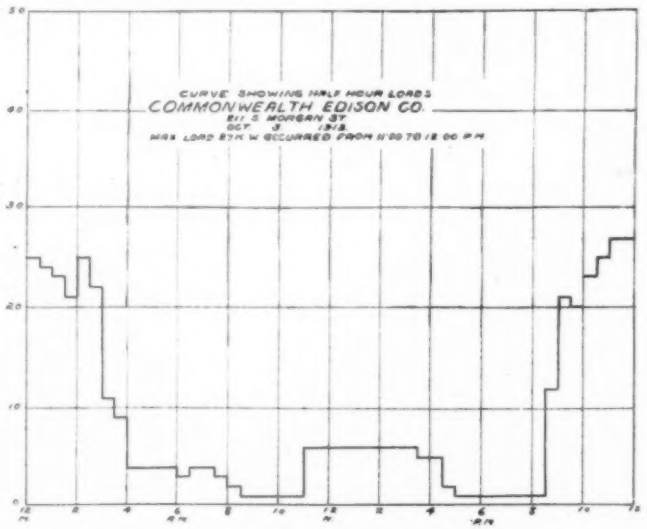
First, we had a pleasure car, then light trucks, and finally heavy electric trucks up to 12 tons capacity. Great improvements have been made in batteries and greater improvements from an engineering standpoint in the construction of electric vehicles and pleasure cars. The result is that we have a vehicle for any class of work desired and each one is, respectively, the best for its class of work; the light, quick delivery, with ease of control, quick to act and good speed; the medium in weight and speed; and the heavy 5 or 7-ton with its safe and sane speed, that is always ready to do the work required—large enough line to fit any class of business and type for every purpose.



Daily Load Curve of a Prosperous Garage.

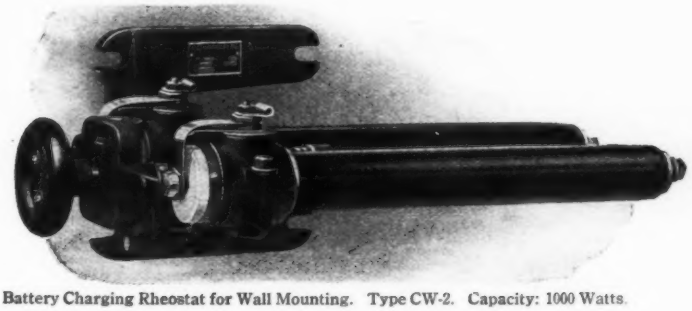
Chicago electric interests have been in favor of electric vehicles for years and are using them to the exclusion of other types of vehicles; Boston has always been a strong advocate; Philadelphia and St. Louis have pushed the electric vehicle constantly, and recently the New York Edison Company has come very strongly to the front in pushing the electric vehicle and today, in New York City, we have nearly 3,000 electric trucks.

The big express companies; the American, Adams, Wells Fargo and others, after a period of try-out of gasolene versus electric cars, go in strongly for the electric car for city service, and it is no experiment with the express companies. Extensive investigation, careful checking of results, was what determined the final decision. In five years there will be thousands of electric trucks in this one service. Now, tell me, why should the electric light and power man hesitate as he is doing at this time?



Load Curve of Garage Charging Electric Vehicles.

Some of the largest fleets are in the brewery interests, one brewery in New



Battery Charging Rheostat for Wall Mounting. Type CW-2. Capacity: 1000 Watts.

Allen-Bradley

Battery Charging Rheostats

vary the resistance with the **pressure** instead of cutting resistance units in and out.

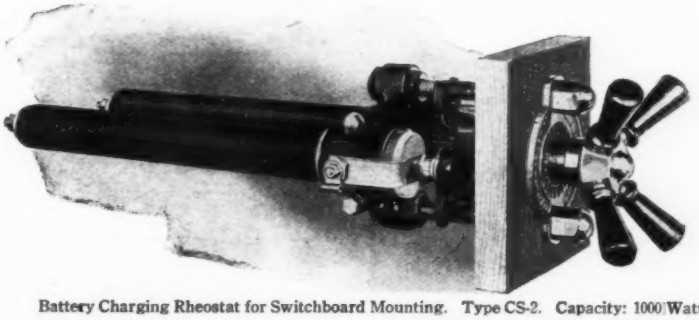
This important feature allows the current to be set **exactly** at any desired value, regardless of the number of cells to be charged. A single rheostat will charge any number of cells, from one up to the maximum number permitted by the voltage of the supply circuit.

Economy of space is secured because with Allen-Bradley Rheostats, compression-type resistance units make brushes, sliding contacts, segments, coils and grids unnecessary. The switchboard type occupies but little space on the face of the board and allows plenty of room for the installation of other apparatus on the same panel.

Bulletin B 40 is full of practical information. Write for a copy at once.

Allen-Bradley Co.

495 Clinton Street, Milwaukee, Wis.



Battery Charging Rheostat for Switchboard Mounting. Type CS-2. Capacity: 1000 Watts.

York having 112 electric trucks of large capacity—all of one vehicle company manufacture, and the breweries have not gone into this in a wholesale way without a try-out. They have taken years to test it out. The result is that a representative of one of the largest breweries in New York made a public statement at the Brewers' Congress in Boston, Mass., October, 1912, that the electric trucks were saving his company over $80,000 per annum in delivery service.

Gentlemen, the electric light company in New York did not sell the brewery company that lot of trucks. It was a matter of indifference to them at the beginning, but not so now. The electric light company is on the job every minute, and employs some of the brightest brains and business talent in the country to push the sale and use of electric trucks and pleasure vehicles.

Now, if this is good business for New York, Chicago, Boston, Philadelphia, St. Louis, and some of the larger cities, why is it not equally important to every one of you who manage or who are responsible for a generating plant and really interested in its success.

A late example is one of our British cousins at Vancouver, B. C., which is starting an active campaign by taking the agency of one of the more prominent electric truck manufacturing company's product, has established charging stations in conjunction with all of its substations, and has put on the best talent that could be found to push this very desirable branch of the electric business, and they are using the electric vehicle in their own service.

Hartford, Conn., has become an agent for a prominent truck and is selling current by the can, as it were, on a flat mileage rate and apparently is a big success.

Because I was in the operating end for over 20 years is the reason I am now reading this paper. I feel that I can see both sides of the question and I know that more that 60 per cent of the men in charge of properties will not do the first thing to help push the electric vehicle. I know of one place where an express company installed some electric trucks but in a few months had to take them away and send to some other city, because they could not get anyone in the city to take care of them properly, and the electric light and power company in that city is supposed to be up to date in every way. I might add that this company used gas cars for their own work.

Some of our central-station men say that the electric truck is too heavy and will not do our work; it takes too much power to move itself, and they do not stop to check up that a five-ton electric truck, with an up to date battery will weigh less than a five-ton standard make gas truck, but it is a fact. That same man will approve of an electric pleasure car that is so built and arranged that it is only carrying one pound of load for every eight to ten pounds of vehicle, while he will hesitate to use or advocate the lighter capacity electric trucks where we have one pound of load for every four pounds of vehicle; and on the five-ton electric truck we just about balance a pound of load for a pound of complete vehicle, so when we come to real efficiency, we excel in the larger capacities. And five-ton trucks will use current on an average, if worked to full capacity of load and mileage, 900-kilowatt-hours per month or 10,800-kilowatt-hours per annum, or in round figures $450 to $500 per annum current cost. Now, suppose you have one hundred five-ton trucks in your city at $500 per annum, that means $50,000 added to off-peak business without a dollar of increase in investment, no more for labor or depreciation, only added cost of coal, water and oil. This I believe, proves what I have said at the start. You are overlooking the one best and biggest thing that it is possible to get.

When the time arrives that it is impossible for a central-station manager to see a wagon load of merchandise passing on the street without mentally translating the impression into terms of dollars and cents, revenue from off-peak load, then he will get busy on promoting electric vehicle activities. At the present time most of you are traveling in the rut of old methods and this business is going by you in streams every day without suggesting to you that it is and should be your business.

In 1910 the railways transported, exclusive of duplication of interchange of freight, 1,026,491,782 tons. Included in the total are manufacturers, 278,157,500; miscellaneous, 71,600,523; stone and sand, 98,861,000 anthracite coal, 117,480,501; animal products, 38,624,775; merchandise, 61,234,757 tons. In transporting this tonnage the railways are using 2,350,000 freight cars, the average load per car was 22.3 tons and required 66,000 locomotives.

It would be interesting to know just what percentage of the total tonnage was of necessity hauled to and from freight terminals; possibly 25 per cent of it was trucked twice, perhaps four times, between the point of original shipment and ultimate destination.

Suppose you should translate these possible ton-miles of truck hauling into terms of kilowatt-hours and then into dollars of revenue? Why, gentlemen, the amount would seem like a dream, but it is a possibility and it is slowly but surely coming. Now let us all try to get some of that revenue while we are here, not leave all of it to the future generation.

We have convinced the live merchant, the big express companies, the entire brewery industry, but the average central station man is still to be shown the light of day.

Development of Load for Battery Charging for Large Department Store Garage.

G.V. Electric Trucks

GENERAL VEHICLE GREATEST VALUE

Over 3000 G. V. Electric Trucks and Wagons are now in daily service, many of them from six to eleven years old.

The General Vehicle Company, Inc., has been the pioneer of the world in developing and standardizing Electric commercial vehicles. Its growth has been slow and sure. Production facilities will be tripled this year, because the G. V. reputation for building a high grade product and selling it as road transportation machinery should be sold, has made this expansion necessary.

Before you motorize—yes, before you buy even your first truck—you owe it to your business to thoroughly investigate our product and our standing.

Six capacities: 750 lbs. to 5-tons.

Catalogue 85 on request.

General Vehicle Company, Inc.

General Office and Factory
Long Island City, N. Y.

New York Chicago Boston Philadelphia

Looking out at the new factory extensions made necessary by our increased business reminds me of my prophecy that the Alkaline Storage Battery would bring about important changes in transportation

Thomas A Edison

Edison Storage Battery Co.

105 Lakeside Ave.
ORANGE, N. J.

The Automobile Industry, 1909.

Statistics of the manufacture of automobiles, including bodies and parts, in the United States for the year 1909 are presented in a bulletin soon to be issued by the Bureau of the Census, Department of Commerce. It was prepared under the direction of W. M. Steuart, chief statistician for manufactures.

Of the 743 establishments engaged in the manufacture of automobiles, including bodies and parts, in 1909, only 265 manufactured complete automobiles as their product of chief value, but these establishments employed more than two-thirds of the average number of wage earners engaged in the entire industry.

The total value of products in the year 1909 for the two branches of the industry combined was $249,202,075, of which $193,823,108 was the value of products reported by the establishments engaged principally in the manufacture of automobiles, and $55,378,967 that reported by establishments manufacturing principally autmobile bodies and parts. The total obtained by adding the figures for these two branches of the industry involves considerable duplication, however; probably a better measure of the actual value of the products of the automobile industry in 1909 would be the total value of the completed machines manufactured, which was $164,269,324.

Of the 126,593 automobiles turned out by establishments of the industry in 1909, all but 23 were made in establishments reporting complete automobiles as the product of chief value. In addition to the automobiles manufactured by establishments assigned to this industry, 694 automobiles were reported by establishments engaged primarily in the manufacture of other products.

Michigan the Leading State.

Michigan was the leading state in the industry, holding first rank at the censuses of 1909 and 1904 in respect to the average number of wage earners employed, the value of products, and the value added by manufacture. In 1909 the factories in Michigan reported 33.6 per cent of the average number of wage earners employed in the industry, 38.8 per cent of the value of products, and 36.4 per cent of the value added by manufacture.

The total number of persons engaged in the industry in 1909 was 85,359, of whom 75,721, or 88.7 per cent, were wage earners, 2,564, or 3 per cent proprietors and officials and 7,074, or 8.3 per cent, clerks—a class which also includes other subordinate salaried employees. Of the persons engaged in the industry in 1909, 82,918, or 97.1 per cent, were males and 2,411, or 2.9 per cent, were females. The average number of children under 16 years of age employed as wage earners in the industry in 1909 was 162, of whom 159 were males and 3 were females.

Of the 743 establishments reported as engaged in the industry in 1909, 56, or 7.5 per cent, had products valued at more than $1,000,000 each. The corresponding figures for 1904 were 10 out of 178 establishments, or 5.6 per cent. Although these establishments were relatively unimportant numerically, they reported a large proportion of the total value of products, the percentage for 1909 (68.4) being much larger than that for 1904 (46.6).

Of the automobiles turned out by establishments engaged in the industry in 1909, 95.1 per cent were gasoline vehicles, the proportion being considerably larger than in 1904 (86.2 per cent). The number of gasoline automobiles made in 1909 was more than six times as great as the number made in 1904. Steam and electric vehicles gained in number at a much less rapid rate, showing increases of 51.4 and 168.5 per cent, respectively, and each of these classes formed a smaller proportion of the total number in 1909 than at the preceding census. In 1904 more steam than electric automobiles were reported, but in 1909 the reverse was true.

Fine Progress by Publicity Committee of Electric Vehicle Association.

The Publicity Committee of the Electric Vehicle Association of America through its chairman, Frank W. Smith, reports great progress in the work of the committee soliciting funds to carry forward for another and second year the national co-operative publicity campaign to promote the use and adoption of the electric pleasure and commercial vehicle.

As already reported in these columns, this Association is doing splendid work for the electric vehicle industry.

The membership of the Association shows a very healthy growth.

The fifth annual convention of the Association will be held at Chicago October 27-28.

The Publicity Committee announces a total amount so far pledged approximating $35,000, and is making a final plea so as to bring the amount to at least the sum expended for the first year.

An especial appeal has been made to the central-station interests, a final plea being in the form of an attractive circular and return stamped post card to those central stations which have not already subscribed asking that every company contribute a "booster" or "good will" contribution of at least something. The return post card is arranged so that the amount of subscription may be indicated by a check opposite the printed figures, this being the only action necessary on the part of the contributor.

Waverleys Take First and Second Prizes in Secret Time Contest at New York.

Members of the Manhattan Automobile Club recently competed in a secret time run to New Rochelle, Ct., given under the auspices of the club. Fifty-four cars were started in the run, and 53 finished. All started from Columbus Circle, New York City. David Beecroft referee of the contest, recently established time records for the run to New Rochelle, which is 17.5 miles from New York. One of the records was for gasoline car and the other for an electric. The records were kept secret. The automobilists drove to see which cars in each class would come nearest to the time limit set.

In the electric class Mrs. Alice Waxham won with a Waverley car. She covered the distance in one hour 24 minutes and 49 seconds. Beecroft's secret record was one hour 20 minutes and 17 seconds. F. S. Rogers finished second in a Waverley. His time was one hour 12 minutes and 36 seconds.

Modern Garage for Louisville Gas & Electric Company.

A modern garage and stable building, in which will be concentrated the transportation department of the new Louisville Gas & Electric Company, of Louisville, is now under construction at Seventh and Ormsby streets in that city. It is 50 by 100 feet in dimensions, and is to be of reinforced concrete construction throughout, a feature being the absence of posts. It will provide quarters for the numerous electric vehicles used by the gas and electric companies, as well as the horse-drawn equipment, which is now cared for at stables at Sixth and Grayson streets. The new building will be heated with natural gas and lighted with electricity. Special facilities for repairs will be provided with a machine and blacksmith shops. The building will be ready for use early in the fall.

Electrics Increasing in New York.

According to statistics gathered by the Automobile Bureau, says the *Edison* (N. Y.) *Monthly*, there were 2,077 electric vehicles in New York City on June 14. Of this number 1,279 were charged from the Edison system.

The following users have ordered additional equipment: Hoffman Brewing Company, 211 East 54th Street, six General Vehicle cars; Best & Company, Fifth Avenue and 35th Street, six Baker cars; Aeolian Company, 27 West 42nd Street, one General Vehicle car; Riker-Hegeman Company, 129 West 27th Street, one General Vehicle and one Detroit; the Herringbone Metal Lath Company, 257 East 133rd Street, one General Motors Truck car.

Books on Electric Vehicles

The Automobile Hand-Book

By L. ELLIOTT BROOKES, Assisted by Other Well-Known Experts

Revised and Enlarged 1911 Edition. 16mo, over 650 Pages and over 320 Illustrations. Full Leather Limp, Round Corners, Red Edges. Price $2.00.

The automobile hand book is a work of practical information for the use of owners, operators and automobile mechanics, giving full and concise information on all questions relating to the construction, care and operation of gasoline and electric automobiles, including road troubles, motor troubles, carbureter troubles, ignition troubles, battery troubles, clutch troubles, starting troubles. With numerous tables, useful rules and formulas, wiring diagrams and over 320 illustrations.

Power transmission is thoroughly discussed, and the various systems of transmitting the power from the motor to the driving axle are analysed and compared.

The perusal of this work for a few minutes when troubles occur, will often not only save time, money, and worry, but give greater confidence in the car, with regard to its going qualities on the road, when properly and intelligently cared for.

This is a brand new book from cover to cover—1911 Edition—and must not be confounded with any former editions of this popular work.

TEXTBOOK ON MOTOR CAR ENGINEERING. By A. G. CLARK

To be complete in two volumes. Vol. I., Construction. 213 illustrations. 6x8¾. Cloth. 457 pp. Price $3.00.

Contents: General Principles and Construction of the Petrol Engine; Details of Engine Construction; Petrol and Other Fuels; Carbureters and Carburation; Thermodynamics of the Petrol Engine; Horse Power; Mechanical, Thermal and Combustion Efficiencies; Principles and Construction of Coil and Accumulator Ignition; Magneto Ignition; Engine Control and Cooling Systems; Crank Effort Diagrams; Clutches and Brakes; Gears, Lubricants, Lubrication Ball and Roller Bearings; Chassis Construction; General Principles of the Steam Car; Steam Engines and Condensers; Steam Generators and Pipe Diagrams; The Electric Car; Materials Used in Motor Car Construction; Examination Papers; Physical Properties of Petrol; Mathematical Tables and Constants.

PRACTICAL AUTOMOBILE DICTIONARY. By S. KRAUSZ

English-French-German; French-English-German; German-French-English. With an introduction by C. J. Glidden. Twelve thousand technical terms and other words employed in connection with motor cars and motoring. For use in office, factory, repair shop and touring in foreign countries. 16mo. Leather. 129 pp. Price $2.00.

SELF-PROPELLED VEHICLES. By JAMES E. HOMANS

A practical treatise on the theory, construction, operation, care, and management of all forms of automobiles. Seventh Edition, revised. 500 illustrations. 6x9. Cloth. 667 pp. Price $2.00.

The various theories and problems involved in the construction and operation of the prevailing types of motor road carriages have been stated as clearly as possible, in order that the involved situations may be readily comprehended by all readers. The fundamental principles of the several types of motor, particularly of the gasoline engine, which is the least understood of all, have been treated at considerable length, in order that the facts may be thoroughly comprehended in their new relations.

THE AUTOMOBILE. By P. N. HASLUCK

A practical treatise on the construction of modern motor-cars, steam, petrol, electric and petrol-electric. Three volumes. Special Edition, enlarged. 1,200 illustrations. 8vo. Cloth. 1,300 pp. Price $10.00.

A very handsome set of instructive books brought up to date in the third volume containing many elaborate illustrations of cars now in use.

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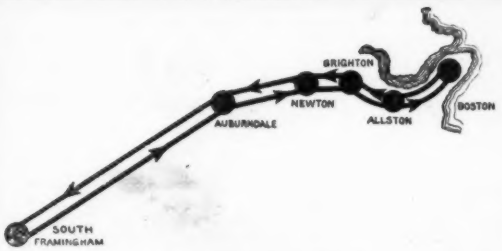
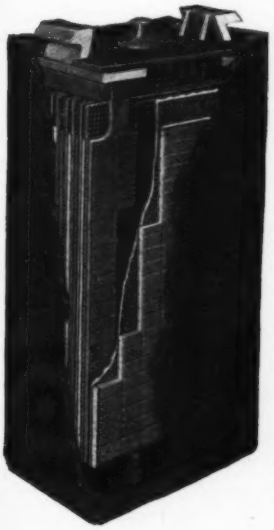
CHICAGO



Good Battery Performance on Delivery Wagons

A large Boston furniture house has a 1½-ton delivery wagon equipped with a Gould Storage Battery. Recently this wagon left their warehouse at 8:30 A. M., with a 1600-lb. load, made deliveries at Brockton, Allston, Brighton, Newton, Auburndale and South Framingham, and returned after the 71-mile trip at 8 P. M. 14 stops were made leaving the net running time 10 hours. The country covered, as you know, is very hilly, and muddy roads were experienced because of rain.

If a salesman sings to you the siren song about new-fangled, high-priced, "guaranteed" batteries that promise results but have no service records, do your own thinking.



Don't pay for several batteries at once, and then partially pay for more at renewal time when the guarantee hasn't made good. Gould batteries sell at the price of one battery each, and no strings are tied to the customers on renewals.

Customers who are experienced in battery service, invariably come back to us voluntarily when they have tried out one Gould Battery, for they want more of the same kind of service.

Write for literature today.

Gould Storage Battery Co.

GENERAL OFFICES: 30 EAST 42nd ST., NEW YORK CITY

BOSTON: 89 State St. DETROIT: 999 Woodward Ave.
PHILADELPHIA: 613 Betz Bldg. CHICAGO: The Rookery
CLEVELAND: American Trust Bldg. SAN FRANCISCO. 904 Rialto Bldg.

WORKS: DEPEW, NEW YORK

Agents WASHINGTON KANSAS CITY DENVER TOPEKA LOS ANGELES SEATTLE MONTREAL TORONTO WINNIPEG

CUTLER-HAMMER

Like a Sectional Book Case

Cutler-Hammer Battery Charging Rheostats Provide for the Future

The following installation data shows how the American Express Company, South Boston Station, began with four rheostats and now have forty-two.

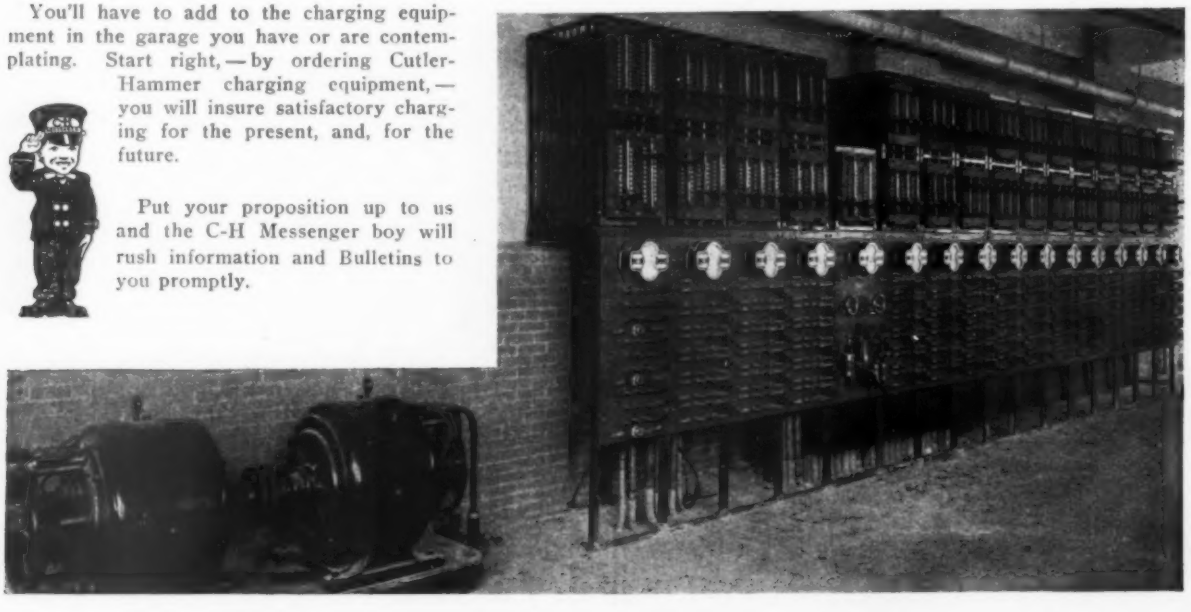
December, 1911..	Installed 1 six-circuit panel.....	4 rheostats
April, 1912.....	Installed	2 rheostats
August, 1912.....	Installed 1 six-circuit panel.....	6 rheostats
November, 1912..	Installed 1 six-circuit panel.....	6 rheostats
January, 1913....	Installed 4 six-circuit panels.....	24 rheostats
Total		7 six-circuit panels, 42 rheostats

The above shows how, with Cutler-Hammer rheostats, provision is made for growth. Only four rheostats were installed at first, but in little over a year this equipment was increased a thousand per cent. —It looks today as if they all had been installed at one time.

The fact that more Cutler-Hammer rheostats were ordered as more electric trucks were used, is a silent but strong testimonial to their satisfactory operation.

You'll have to add to the charging equipment in the garage you have or are contemplating. Start right,—by ordering Cutler-Hammer charging equipment,—you will insure satisfactory charging for the present, and, for the future.

Put your proposition up to us and the C-H Messenger boy will rush information and Bulletins to you promptly.



THE CUTLER-HAMMER MFG. CO. MILWAUKEE

NEW YORK: Hudson Terminal 50 Church Street CHICAGO: Peoples Gas Bldg. PITTSBURG: Farmers' Bank Building
BOSTON: Columbian Life Bldg. PHILADELPHIA: 1201 Chestnut Street CLEVELAND: Schofield Building
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and W. B. Palmer, 416 East 3rd St., LOS ANGELES.